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UNITED STATES DEPARTMENT OF THE INTERIOR
J. A. KRUG, Secretary
BUREAU OF MINES
R. R. SAYERS, Director

MINERALS YEARBOOK
1945

Prepared under the direction of
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Economics and Statistics Branch

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FOREWORD

In the victorious outcome of World War II, the mineral industries can deservedly take well-earned pride. The statistical and descriptive data presented in this edition of Minerals Yearbook reflect, for the war years, a remarkable record of accomplishment on their part. Throughout the conflict, the Bureau of Mines also devoted its full strength in all fields of its endeavors to the common cause, not only providing industry and Government those services with which it is normally charged but also special services arising from the national emergency. Executive and administrative personnel, engineers and technicians, economists and statisticians, safety and welfare workers, and the large number of clerical and other employees—whether in the Washington, D. C., headquarters, in the field offices of the Bureau, in research laboratories engaged on important investigations, or in mineralized areas seeking sources of critical and strategic raw-material supplies—all contributed in an outstanding manner to the Bureau's war work. Moreover, as in the mineral industries, both professional and nonprofessional personnel of the Bureau entered the armed forces. In all, 529 men and women from the Bureau of Mines so served their country; of these, 207 have returned to their former positions in accordance with the military furloughs granted them; and 12 gave their lives in that service.

Minerals Yearbook, 1945, like earlier editions, is a monument to the cooperative effort of industry and Government—without such effort there could not be such a volume. It is a pleasure therefore to acknowledge again the full share of credit owing the numerous branches of the mineral industries, trade associations, industry publications, and the thousands of companies and individuals that have provided information required in its publication. Likewise, the cooperation received, as heretofore, from other Federal and State agencies is gratefully acknowledged, particularly that from the United States Department of Commerce, which provided the data on exports and imports, and that from those States which have executed cooperative agreements with the Bureau. Under these agreements, producers and consumers of minerals complete but one set of inquiries, and the State officials are given the detailed information supplied to the Bureau of Mines by respondents in their respective States. State agents cooperating in the 1945 canvass were: Walter B. Jones, State geologist, University, Ala.; Herman Gunter, State geologist, Tallahassee, Fla.; Garland Peyton, director, division of mines, mining, and geology, department of natural resources, Atlanta, Ga.; M. M. Leighton, chief, and Douglas Stevens, research associate, State geological survey division, Urbana, Ill.; A. C. Trowbridge, director, Iowa Geological Survey, Iowa City, Iowa; Raymond C. Moore, State geologist and director, and John C. Frye, assistant State geologist and assistant director, State Geological Survey of

Kansas, Lawrence, Kans.; J. T. Singewald, Jr., director, department of geology, mines, and water resources, board of natural resources, Baltimore, Md.; R. A. Smith, State geologist, Lansing, Mich.; Edward L. Clark, State geologist, Rolla, Mo.; Edward Ellingwood, chairman, New Hampshire Mineral Resources Committee, Concord, N. H.; Meredith E. Johnson, State geologist, Trenton, N. J.; John G. Broughton, assistant State geologist, New York State Museum, Albany, N. Y.; Jasper L. Stuckey, State geologist, Raleigh, N. C.; Robert H. Dott, director, Oklahoma Geological Survey, Norman, Okla.; E. P. Rothrock, State geologist, Vermillion, S. Dak.; John T. Lonsdale, director, bureau of economic geology, Austin, Tex.; Arthur Bevan, State geologist, and Linwood H. Warwick, chief clerk, Virginia Geological Survey, Charlottesville, Va.; Sheldon L. Glover, supervisor, division of mines and mining, department of conservation and development, Olympia, Wash.; R. C. Tucker, assistant State geologist, Morgantown, W. Va.; and E. F. Bean, State geologist, Madison, Wis. In addition, B. D. Stewart, department of mines, Juneau, Alaska, and Walter W. Bradley, State mineralogist, San Francisco, Calif., assisted in the compilation of statistics for Alaska and California, respectively.

R. R. SAYERS, *Director*.

CONTENTS

INTRODUCTION

Reconversion to prewar scope and coverage has been the principal objective in the compilation of Minerals Yearbook 1945. Achievement of this goal involved more than the usual degree of care and patience, owing chiefly to the difficulty of collecting authoritative data in the immediate postwar period. An endeavor has also been made to expand the world aspects of the volume, in keeping with the broadened interest in the international status of mineral commodities. The large measure of success that the various chapters reflect in this respect may be attributed to the removal of practically all protective security restrictions on the publication of mineral production statistics, and to the detailed information contained in reports submitted by military Government officials in occupied countries and by mineral specialists serving as United States representatives in other countries.

Acknowledgments.—On May 31, 1946, Martha B. Clark retired from the Bureau of Mines after 46 continuous years of Government service, practically all of which were devoted to Minerals Yearbook and its predecessor, Mineral Resources of the United States. We in the Bureau regretted to have her leave the organization, but at the same time it was gratifying to see the leisure of retirement come to one who had so faithfully and loyally earned it. In addition to review of the entire volume for statistical consistency and accuracy, Miss Clark was the author of the keystone chapter—Statistical Summary of Mineral Production. To its preparation she gave year-round and painstaking editorial and statistical consideration; her records were the basis not only for the chapter but also for many statistical investigations undertaken in the Economics and Statistics Branch. Commodity specialists, division chiefs, branch heads, and numerous others sought her counsel, including—unbeknown to them—many in industry whose inquiries relative to mineral statistics were referred to Miss Clark for preparation of the appropriate letter of reply. On the part of Government and the public a debt of gratitude is owing Martha B. Clark—a true public servant.

In the preparation of the 1945 edition of Minerals Yearbook special credit is due Marian E. Meyer, of the Economics and Statistics Branch, successor to Miss Clark as author of the Statistical Summary chapter; Mabel E. Winslow, of the Office of Mineral Reports, who, with Anna B. Brown, edited the entire manuscript and who prepared the index; Louis F. Perry, of the Office of Mineral Reports, and Adelaide B. Palmer, of the Economics and Statistics Branch, for the preparation of charts; Eleanor C. Reid, of the Administrative Service, who assisted in reading proof; and John H. Ady, Chief of Publications of the Interior Department and liaison officer between the Department and the United States Government Printing Office, who contributed invaluable advice in the development and execution of the publishing program.

Furthermore, credit is owing the statistical analysts and others of the Economics and Statistics Branch who were of major assistance to authors in the compilation of the statistical material that appears in the various chapters. In the Washington, D. C., offices of the branch, Charlotte R. Buck, Marie R. Haney, Annie L. Marks, Robert C. Morris, Virginia M. Oliver, Anne Taeves, and Birley E. Vinskey were engaged on such work; in the Los Angeles, Calif., office, Edward T. Knudsen; in the San Francisco, Calif., office, Opal Y. Sharman; in the Denver, Colo., office, Helen G. Post, Florence H. Scott, and Tressa B. Westall; in the College Park, Md., office, Edith E. denHartog and Helen P. Mackall; and in the Salt Lake City, Utah, office, Alice Feltch, Virginia Halverson, LaRu T. Shepherd, and Edna P. Wolfgramm.

H. D. Keiser.

Part I. General Summary

REVIEW OF THE MINERAL INDUSTRIES IN 1945[1]

By E. W. Pehrson and H. D. Keiser

SUMMARY OUTLINE

INTRODUCTION

In 1945, for the first time since 1938, the total value of mineral production moved downward. The recession followed three successive peak years, years in which minerals were mined in the United States in unprecedented quantities to meet the demands of war for essential raw materials. Total value in 1945—$8,143,000,000—was 3.3 percent below the 1944 peak of $8,419,000,000 but 47.0 percent above the World War I high value of $5,540,708,000 recorded in 1918 and 16.6 percent more than the prewar high of $6,981,340,000 established in 1920. The decline in total value in 1945 was directly attributable to a decrease in the physical volume of production that more than offset a slight increase in the unit sales realizations of mineral producers.

Production in the mineral industries was again retarded by a shortage of manpower. The total labor force, which in 1944 declined 9 percent compared with 1943, shrank 6 percent in 1945 compared with 1944. Decreased demand for some minerals following termination of war contracts and labor disturbances, principally in the coal industry, resulted in a 10-percent reduction in total man-hours worked in 1945; this reduction continued the trend of 1944, when a 1-percent reduction was registered. Other factors adversely affecting mineral production included the lag in industrial reconversion from wartime to peacetime operations following VJ-day; the difficulty and, ofttimes, inability experienced by mining interests in obtaining necessary supplies and equipment required to replace that worn out in the course of expanded production effort during the war period; increasing costs; and, in the instance of some minerals, the depleted state of ore reserves

[1] In this report the term "billion" is equivalent to 1,000,000,000.

owing to heavy production over the war years without compensating development work to maintain such reserves at prewar level.

Industrial production reached its peak in the latter part of 1943, according to the monthly index of the Federal Reserve Board; the trend since then continued virtually steadily downward through 1944 and 1945. The Board's annual index of mineral production reached its highest level in 1944 and declined 2.1 percent in 1945. Although the consumption of some mineral commodities, particularly the liquid fuels and fertilizer minerals, established new records in 1945, that for many others, including most of the more important metals and coal, dropped appreciably, with the result that total mineral consumption in all probability decreased slightly. Total mineral production likewise declined, the gain made by the fuels as a group and the other nonmetals failing to offset the substantial losses in output suffered by the metals. Both Government and industry stocks were lower at the end of the year, despite increased imports; Government inventories were pared down markedly as the need for war munitions diminished.

Price levels, as reflected by producers' unit realizations, moved upward in 1945; metals and fuels exhibited the more important gains. The increase in producers' price realizations, which was estimated at 2.4 percent over 1944, compared favorably with the 1.7-percent rise in the Bureau of Labor Statistics indexes of wholesale prices for all commodities.

PRODUCTION

Value of mineral output.—The 3.28-percent decline in the total value of mineral production in 1945 resulted from a 15.60-percent decrease in the value of metallic output. Value of the production of fuels was 0.66 percent higher and that for the other nonmetallics 6.10 percent greater. Although metals represented only 24.3 percent of the total value, whereas fuels represented 64.0 percent and other nonmetallics 11.7 percent, the sharp drop in metallic valuation more than offset the gains made by fuels and the other nonmetallics. Comparative valuation figures in 1944 and 1945, with the 1944 figures in parentheses, were as follows: Total mineral production, $8,143,000,000 ($8,419,000,000); metallic, $1,975,000,000 ($2,340,000,000); fuels, $5,212,000,000 ($5,178,000,000); and other nonmetallic, $956,000,000 ($901,000,000). Trends in the production value of these branches of the mineral industries since 1880 are shown in figure 1.

In marked contrast to the situation in 1944 when minerals scored a 4-percent gain in value that compared favorably with advances made in other parts of the economy, the 3.28-percent decline in mineral value in 1945 compared with a 2.89-percent increase in gross farm income, as reported by the United States Department of Agriculture ($23,893,000,000 in 1944 and $24,584,000,000 in 1945, including Government payments), and with an 0.80-percent increase in gross national product from $197,600,000,000 in 1944 to $199,200,000,000 in 1945. War expenditures comprised 35 percent of gross national product in 1945 and 42 percent in 1944. National income increased 0.19 percent from $160,700,000,000 to $161,000,000,000 (unrevised), according to the

United States Department of Commerce. Compared with 1939 the value of mineral production in 1945 had increased only 66 percent whereas gross farm income increased by 133 percent, gross national product by 123 percent, and national income by 127 percent.

Explanation of the decline in mineral value in 1945, in the face of the aforementioned increases, may be attributed to several factors. Some minerals, notably gold, silver, and certain building materials, were adversely affected by war conditions, and after VJ-day the rate of improvement was so slow in the respective industries that for the

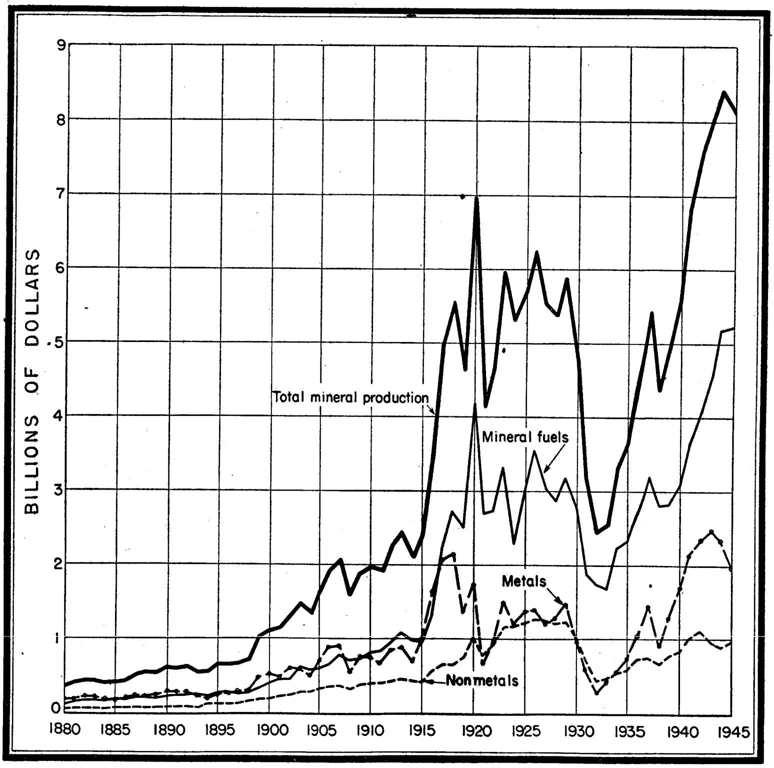

FIGURE 1.—Trends in value of mineral production in the United States, 1880–1945.

year their downward trends of 1944 were continued. Manpower shortages and labor disturbances were outstanding deterrents in the attempt to meet existing demand for some minerals, particularly coal and a number of the metals. Difficulty in obtaining mining supplies and new equipment to replace that worn out during the war period also retarded the execution of plans for reconversion to peacetime operation in many mineral industries. Moreover, as will be shown later, the prices of minerals over the war years advanced much less than those for other commodities; in consequence, upward movem of the total value of mineral production has been impeded.

Trends in physical volume of production.—Figure 2 compares the physical volume of mineral production during the last 46 years with industrial and agricultural production and with population growth, each expressed in terms of an index based upon yearly averages for 1935–39.[2]

During this 46-year period, a steadily upward trend in production has prevailed, with year-to-year and cyclical fluctuations prominent.

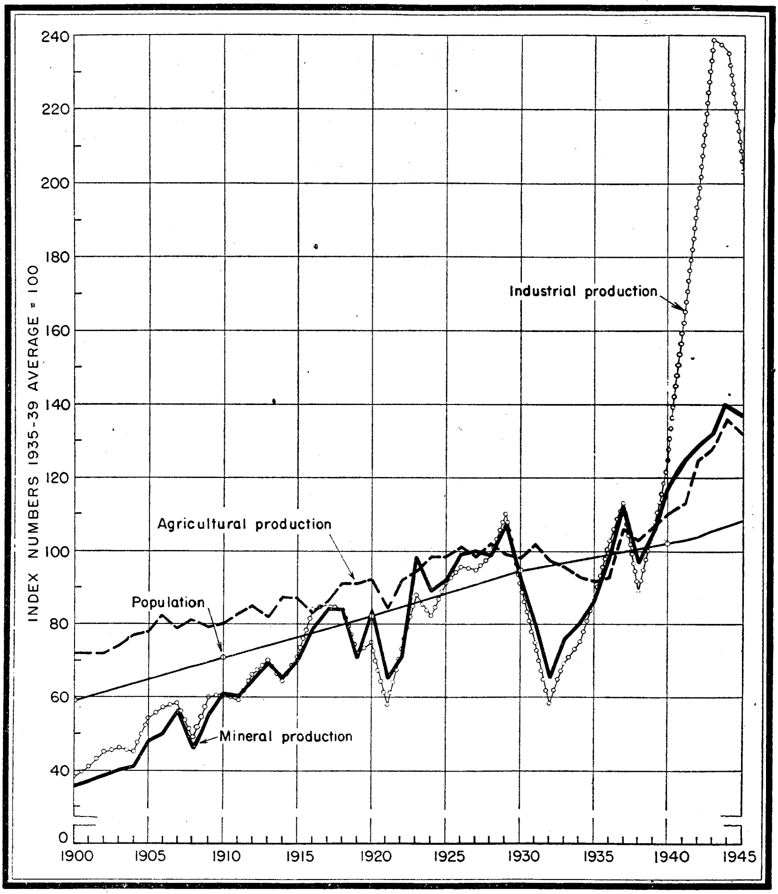

FIGURE 2.—Comparison of growth of physical volume of mineral production with that of agricultural and industrial production and population, 1900–1945.

Mineral production, except for the years of World War II, has kept closely in step with industrial production, reflecting the essentiality of mineral raw materials in the industrial economy. Fluctuations in agricultural production have been over a narrower range, with the

[2] The following indexes have been used: Volume of farm production, U. S. Department of Agriculture; mineral production, 1900–1918, Warren Persons' Forecasting Business Cycles; mineral production of 1919–45 and industrial production, Federal Reserve Board; total population of the United States, Bureau of the Census.

general upward movement of the growth line exhibiting approximate correlation with the growth in population.

Production of coal for domestic use and of petroleum for automobile fuel is relatively stable and has a decided influence on the trend of mineral output because it does not vary proportionately with changes in the rate of industrial activity. For this reason the index of mineral production tends to fall below the index of industrial production in periods of prosperity and to rise above it during depressions. The marked divergencies between the two indexes from 1941 to 1946 may be attributed in part to this characteristic. Substantial imports of minerals during the same years, to augment domestic supplies in the manufacture of munitions, has had the same general effect, inasmuch as their utilization has been reflected in the index of industrial production but not in the index for domestic mineral production. Further, certain mineral products, notably aluminum and magnesium, are not included in the Federal Reserve Board index of mineral production, whereas the index of industrial production involves the huge expansion in the output of aircraft during the war years that required unprecedented quantities of these two metals.

Notwithstanding a decline in the total production of minerals, new output records were established in 1945 by a number of minerals, particularly among the nonmetallics. Barite, feldspar, phosphate rock, potash, and sulfur all advanced to new high levels. Of the fuels, new peaks were recorded for crude petroleum, natural gasoline and liquefied petroleum gases, and natural gas, which gained 2, 11, and 4 percent, respectively. Titanium and nickel were the only metals to reach new heights. Bituminous coal dropped 7 percent from its 1944 peak and anthracite fell 14 percent. Plagued by continuing shortages of manpower and inefficiency of operating forces, mine production of copper, lead, and zinc—of the common metals produced in quantity in the United States—declined in output by 21, 6, and 15 percent, respectively; lead receded to the lowest level since 1938 and copper and zinc to the lowest levels since 1939. Output of virtually all the other metals suffered from the declining rate of war production in the first half of the year and from contract terminations and the lag in industrial reconversion after VJ-day. Arsenic decreased 33 percent; cadmium, 6 percent; chromite, 69 percent; iron ore, 4 percent; manganese ore, 26 percent; molybdenum, 20 percent; tungsten, 45 percent; and vanadium, 16 percent. Both aluminum and magnesium dropped sharply, by 36 and 79 percent, respectively. The position of the precious metals continued to deteriorate; gold decreased 4 percent, thus establishing a new low record since its discovery in California in 1848, and production of silver declined 16 percent. Besides titanium and nickel, increased production was achieved by platinum, selenium, and tellurium. Among the more important nonmetals—in addition to those already mentioned—increased production in 1945 was recorded for asbestos, cement, clay, gypsum, petroleum asphalt, sand and gravel, and slate; none of these, however, reached a new high level of output. Production of natural asphalt, fluorspar, graphite, lime, magnesite, mica, salt, and stone decreased.

STOCKS

With the end of the war coming near the middle of 1945 and reconversion to peacetime operations generally in progress the remainder of the year, the trend of inventories over the 12-month period was far from uniform for most of the more important minerals; however, the predominant change in stocks at the end of the year, compared with levels that prevailed a year earlier, was downward. Government stocks, particularly, were pared down, and about two-thirds of the entire list of more than 50 different minerals so held reflected the effect of decreased or suspended purchasing and the release of stocks to industry. For a group of 11 minerals, both industry and Government stocks declined; this group comprised antimony, arsenic, bauxite, beryllium, bismuth, cadmium, magnesium, mica splittings, platinum, tin, and vanadium. With the exception of bauxite, magnesium, and platinum, the decline in Government holdings of these 11 minerals exceeded, in quantity, the decline in industrial holdings by a substantial margin. Industry inventories of bauxite and platinum declined moderately more than Government inventories, but in the instance of magnesium the decline in industry stocks was much the greater. Inventories of cryolite, Indian kyanite, and tungsten held by industry increased, but the decline in Government holdings of each of the 3 minerals more than offset the industry increases. Although Government stocks of molybdenum increased, a marked decline in industry holdings resulted in a net stock loss for the metal. Net gains in stocks were registered for 12 minerals, including most of the major nonferrous metals. Increases in industry inventories of aluminum (probably), graphite, lead, mercury, and zinc exceeded, in each instance, losses in Government holdings; and, for chromite, the increase in Government holdings exceeded the decrease in industry inventories. Both industry and Government stocks of cobalt, copper, fluorspar, manganese ore, nickel, and titanium increased.

The general trend of industry inventories was also downward for those mineral commodities not held by the Government; this was notably true with respect to the mineral fuels. Stocks of bituminous coal and anthracite and coke decreased, and likewise those of crude petroleum, natural gasoline, and refined oils. Inventories of phosphate rock dropped sharply, whereas more moderate declines were reported for cement, selenium, and sulfur. Slight to moderate gains in stocks were recorded for iron ore, petroleum asphalt, potash, and tellurium.

Goals for Government-owned stock piles were set in June 1945 at 3 months' military requirements as established for the second quarter of 1945. Following VJ-day, Government controls on most raw materials were gradually removed, and stock-pile objectives were practically abandoned. These developments and subsequent action relative to the future disposition of Government stock piles are discussed under the section of this chapter entitled "Government Stock-Piling Activities."

CONSUMPTION

Over-all consumption of mineral commodities in 1945 reflected the lag in reconversion of industry for peacetime purposes from the wartime efforts of the immediately preceding years. Although about the same number of individual increases and decreases in consumption was recorded in a statistical analysis of 74 of the more important minerals, total mineral consumption was in all probability on a decreased scale as compared with 1944. Consumption of each of the major nonferrous metals—copper, lead, zinc, and tin—and of iron ore declined. Petroleum, natural gas, and natural gasoline consumption increased, but the consumption of anthracite and bituminous coal decreased; collectively, the energy supply from these 5 mineral fuels declined 4 percent. Slow improvement in certain categories of the construction industry resulted in decreased consumption of several of the nonmetallic minerals used for construction purposes.

The Federal Reserve Board index of industrial production declined from 235 in 1944 to 203 in 1945 (1935–39 average=100) after advancing to 239 in 1943 from 89 in 1938 and 109 in 1939. The monthly record shows that the peak war production was attained in October and November 1943, when the adjusted index stood at 247; from January to December 1944 the monthly index declined from 243 to 232 and from January to December 1945 from 234 to 163. The durable manufactures index, which was 78 in 1938 and 109 in 1939, rose to 360 in 1943, declined to 353 in 1944, and fell to 274 in 1945. The production index for transportation equipment, including airplanes, automobiles, ships, railroad cars, and locomotives, advanced from less than 100 early in 1939 to a peak of 786 in November 1943, fell back to 709 in December 1944, and dropped to 217 in December 1945.

Undoubtedly, the 14-percent decline in industrial production in 1945, as indicated by the Federal Reserve Board index, was greater than the over-all decrease in mineral consumption, although consumption of a few of the key mineral commodities, including iron ore, lead, and anthracite, declined to about that degree. A lower over-all decrease in mineral consumption would, in the main, be attributable to a less severe effect of contract terminations, in the second half of 1945 following the end of the war, in the raw-material industries than in the processing and finished product industries. Evidence of this lower decrease is seen in the 2-percent decline in 1945 of the mineral production index of the Federal Reserve Board; this index, which applies to the mineral fuels and most of the major metals, stood at 140 for 1944 and 137 for 1945.

Contract terminations, manpower shortages and labor disturbances, difficulties in obtaining necessary equipment and supplies, and other obstacles to expeditious industrial reconversion to peacetime operations were the principal underlying causes of decreased mineral consumption in 1945. Steel production decreased 11 percent, involving a 14-percent reduction in the consumption of iron ore and an 8-percent decrease in the demand for manganese ore. With a decline of 19 percent in the production of alloy steels, a lower level of consumption was recorded for the major ferro-alloy minerals. The decreased scale of general industrial activity was also reflected in a 13-percent reduction in the consumption of anthracite and a 5-percent decrease for bituminous coal. Lead consumption declined 12 percent; tin, 6 percent; copper, about 10 percent; and zinc, 4 percent. The most precipitous drop in consumption, among the metallic mineral commodities, was that of 67 percent for magnesium; this sharp decrease resulted from a marked falling off in demand for the metal for war purposes. Consumption of bauxite dropped 30 percent, largely because of the reduced rate of production of alumina for the aluminum industry. The more important mineral commodities that achieved new records of consumption in 1945 included petroleum, natural gas, natural gasoline and liquefied petroleum gases, phosphate rock, potash, silver (in the arts and industries), platinum, mercury, titanium, barite, carbon black, and sulfur. On a percentage increase basis, the consumption of mercury was outstanding, demand for the metal increasing 49 percent, principally as the result of its utilization in the manufacture of an improved dry battery which was required in substantial quantities by the armed forces in 1945.

Privately financed construction increased 63 percent in 1945, whereas public construction, owing to completion and suspension of construction for war needs, decreased 16 percent. According to the United States Department of Commerce, the total value of all new construction put in place in continental United States during the year was $4,661,000,000, a 15-percent increase from $4,049,000,000 in 1944 but a 65-percent drop from the peak of $13,498,000,000 in 1942; the value in 1938 was $5,274,000,000. The major increases in 1945 were in private commercial, industrial, and residential construction. As a consequence of these increases, consumption of a number of building materials of mineral origin, including cement, clays, gypsum, sand and gravel, and slate, increased moderately in 1945.

PRICES

For the third consecutive year, average mineral prices in 1945 advanced more than the general price level. An index of producers' unit realizations on 24 minerals that represented over 97 percent of the value of mineral production, weighted according to 1940 production, showed an average increase of 2.4 percent over 1944. Bureau of Labor Statistics indexes of wholesale prices for all commodities rose 1.7 percent; however, prices for farm products increased 4.0 percent. During the entire war period prices for minerals advanced much less than those of other commodities. Since 1940 unit price realizations for minerals have increased only 25.7 percent, whereas prices for all commodities have risen 34.6 percent and those for farm products 89.4 percent. These computations for minerals include premium prices paid for copper, lead, and zinc but do not include the transportation subsidies paid by the Government on other commodities.

During the war years fuel prices fared better than other mineral prices. Since 1940 the weighted average price realization by producers of 5 mineral fuels has increased 30.1 percent; 1945 averages were 2.4 percent over those in 1944. Average prices for 10 metals rose 21.2

percent from 1940 to 1945 but only 2.5 percent from 1944 to 1945. The index of prices for 9 nonmetallic minerals other than fuels advanced 15.7 percent from 1940 to 1945 and 1.6 percent from 1944 to 1945.

Aside from a number of regional and individual-company adjustments, principally among the nonmetallics, there were relatively few changes in ceiling prices in 1945. Of particular significance, however, were those for coal, granted largely as a result of wage increases, and those for pig iron to compensate for increased over-all production costs. Ceilings for copper, lead, and zinc were maintained at 1944 rates, but a larger proportion of the domestic production of all three metals came under premium prices. The average price of lead realized by producers in 1945 increased 0.6 cent per pound compared with 1944, and that for zinc advanced 0.1 cent; the average price of copper was unchanged. The average value of petroleum at the well was slightly higher in 1945 than in 1944, whereas the average value for natural gas at points of consumption and that for natural gasoline at producing plants were both slightly lower. With the exception of peat and crude and ground feldspar, prices of which declined, producers of nonmetallics generally received slightly higher or the same unit returns in 1945 as in 1944.

The Bureau of Labor Statistics index (1926=100) of wholesale prices for all commodities rose from 78.6 in 1940 to 104.0 in 1944 and 105.8 in 1945. The index for farm products was 67.7 in 1940, 123.3 in 1944, and 128.2 in 1945 and showed the greatest rise during the war period of any major group of commodities. The fuel and lighting index increased from 71.7 in 1940 to 83.0 in 1944 and 84.0 in 1945, and the index for anthracite rose from 95.6 in 1944 to 99.0 in 1945, for bituminous coal from 120.3 to 123.1, for coke from 130.3 to 132.5, and for petroleum and its products from 63.5 to 64.3. The metals and metal products index was 104.7 in 1945 and 103.8 in 1944 compared with 95.8 in 1940; fabricated products weigh heavily in the computation of indexes for this group. In the building materials field, the group index showed a slightly better than average rise in 1945—117.8 compared with 115.5 in 1944 and 94.8 in 1940. The price index for fertilizer materials was 81.6 in 1945, 81.3 in 1944, and 69.4 in 1940.

EMPLOYMENT

Manpower was scarce at mineral operations; and labor shortages, which had become progressively more acute since 1942, were continued through 1945. However, the continued downtrend in the number of men working daily was reversed soon after midyear and by the end of the year the labor-shortage problem had been eased to some extent. In the forepart of the year the labor supply had continued to shrink as Selective Service requirements for men for the armed forces were enlarged and production requirements for mineral raw materials were maintained at a high rate. The prompt termination of war contracts, the closing of munitions, armament, ship-building and other war-fostered industries, and the release of men from the armed forces shortly after the end of the Pacific war were factors in the uptrend in the number of men working during the latter part of the year. The easement of the labor shortages was greater in some

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mineral industries than was indicated by the uptrend in the labor force owing to the declining demand for many mineral raw materials as war contracts were voided and the mineral-consuming industries were converted to peacetime production. Demand for raw materials was reduced further toward the close of 1945 by the wave of strikes that virtually closed several important mineral-consuming industries. Despite these factors fostering an abatement of the labor supply problem, manpower shortages were prevalent in the mineral industries at the end of 1945.

Concomitant with the easing of the labor-supply problem, war controls on manpower were relaxed or abandoned. Selective Service requirements were reduced to a minimum, and the labor priority referrals (established in 1944) and other controls of the War Manpower Commission on the movement of labor were discarded soon after the end of the Pacific war.

Labor-management relations during 1945 were stable in each of the mining industries except coal, in which three major work stoppages—two in bituminous-coal and one in anthracite mines—as well as numerous minor shut-downs resulted from industrial disputes. A total of 670 work stoppages started during 1945 in all mining industries and caused a loss of slightly more than 6¼ million man-days of work, according to the United States Department of Labor.[3] Virtually all of this economic loss was in the coal industry, where 598 stoppages at bituminous-coal mines caused idleness for 5 million man-days and 43 stoppages at anthracite mines resulted in a loss of nearly 1¼ million man-days. The Solid Fuels Administration stated that 30 million tons of bituminous coal and nearly 4 million tons of anthracite were lost through strikes during 1945. In petroleum refining, 30 work stoppages during the year caused a loss of 429,000 man-days of work. A widespread 20-day stoppage resulting from a wage dispute was ended on October 4, when the major refining plants were seized and operated by the Federal Government.

In the coal industry, the major work stoppage at bituminous-coal mines on April 3 and that at anthracite mines on May 1 resulted from labor-management disputes on the so-called "fringe issues" (portal-to-portal pay, shift differentials, vacation pay, welfare fund, etc.) of the wage contracts. In both strikes, the Federal Government seized the mines to continue operations until agreements were reached by compromise between labor and the mine owners. The bituminous-coal mines were returned in small groups to the owners over a period of several months, and the anthracite mines were released for owner operation on June 23 after a majority of the anthracite workers had resumed their jobs on May 21. A second major stoppage at bituminous-coal mines started about September 21 at a few coal mines and spread rapidly until more than 200,000 mine workers were idle. The dispute was concerned with recognition of a supervisory employees' union and the privilege of this class of employees to unionize. Union officials terminated the strike, and mining was resumed on October 22. Several new issues were introduced in the 1945 coal disputes.

[3] U. S. Department of Labor, Bureau of Labor Statistics, Work Stoppages Caused by Labor-Management Disputes in 1945: Bull. 878, 1946, 41 pp.

Mine safety became a consideration of prime economic importance, and the union demanded a miners' health and welfare fund to be subsidized by a royalty on production. Although these issues and the right of supervisory employees to unionize were not parts of the final settlements, they did foretell union aims in future demands and negotiations.

A difficult employment problem was posed in 1945 by the obvious antipathy of the younger men to entering or returning to mining as a permanent occupation. The principal means employed by the companies to combat this reluctance was the establishment or the expansion of training schools for new or returned employees to provide skilled men for underground work. It was evident, however, that additional inducements were needed so long as higher-paying or less arduous work was available in other industries.

The uptrend in manpower in the latter part of the year was not of sufficient magnitude to affect the drastic withdrawals in the first half, and the average number of men working in the mining and refining industries during 1945 fell to 639,800, a 6-percent decline from 1944. This skeletonized labor force worked approximately 1⅓ billion man-hours, or 10 percent less than in 1944, owing principally to the reduced demand for some minerals and the work stoppages in the coal industry. All mineral operations in the country were active an average of only 273 days (13 less than in 1944), and the average employee worked 2,169 hours in 1945 compared to a workyear of 2,264 hours in 1944. The average length of shift in 1945—7.94 hours—was relatively unchanged from 1944.

The monthly pattern of employment in the mineral industries during 1945 probably followed that shown by a monthly review of the average number of men at work daily in bituminous-coal mines. In this series employment declined irregularly from 369,000 in January to 357,000 in August and turned upward to reach a total of 369,000 in November. The average for December declined to 365,000 owing probably to greater than usual absenteeism over the holidays. For 1945, the average number of men in bituminous-coal mines totaled 363,000 or 4 percent below 1944. In the anthracite industry, employment declined to 74,000 men and was the principal factor limiting production during 1945. At metal mines the average number of men working fell 12 percent from 1944 to a total of 62,200 in 1945. The labor shortage in some metal-mining industries was offset partly by increased activity at open pits, which have a higher productivity per man-hour than underground mines. Employment in the nonmetal mining and quarrying industries advanced over 1944 to respective totals of 12,200 and 59,400 in 1945. These gains indicated rapidly increasing employment in the closing months of the year, following removal of war restrictions on construction which materially affected demand and activity in important segments of these industries. At coke plants the number of men declined moderately to a total of 23,100 in 1945. Employment at metallurgical plants (ore-dressing mills and nonferrous smelters, refineries, etc.) fell sharply to 45,900 men in 1945, owing principally to the closing of Government-owned plants before and after the end of the war and to the general shortage of labor.

SAFETY

Safety at mineral operations in the United States continued to improve in 1945, and the over-all injury experience as measured by frequency per million man-hours of exposure to hazards was better than in any year since the start in 1931 of complete injury statistics on mining and quarrying. The more favorable safety record in 1945 was attained despite such adverse factors as the heavy production requirements (which necessitated more than usual days of work at longer hours per day with a skeletonized labor force through the first half of the year) and, in the latter part of the year, general relaxation of the workers (which made accident-prevention work more difficult after the end of the war when pressure for production was less urgent). The easing of the critical labor shortage indicated in the last 4 months of the year probably helped reduce the frequency of injuries at mineral operations. The greater number of men at work doubtless lowered the worker-fatigue that had been induced by the long work week in the fore part of the year.

Injuries in the mineral industries occurred at a rate of 55.69 per million man-hours in 1945—a slight reduction from a frequency of 56.61 in 1944. Fatalities happened at a rate of 0.93 per million man-hours of working time and for the first time since the statistical series started in 1931 were at a frequency of less than 1 per million man-hours. There was a slight improvement in nonfatal injury experience in 1945, and the frequency of occurrence was reduced to 54.76 per million man-hours from a corresponding rate of 55.59 in 1944.

Accidents in mineral operations during 1945 resulted in a total of 77,290 injuries, of which 1,285 were fatal and 76,005 were nonfatal lost-time injuries that disabled the injured person for longer than the day of the accident. Although this represented a marked reduction from the total of 87,242 injuries in 1944, the frequency rate per million man-hours was improved only slightly in 1945 owing to the shorter time of exposure of the workers to hazards. The average of 639,800 men, who reported daily, worked or were exposed to hazards for a total of slightly more than 1⅓ billion man-hours in 1945, an appreciable reduction from the 1½ billion hours of exposure in 1944.

Five major disasters occurred during 1945, all in bituminous-coal mines. Four of the disasters were mine explosions which caused a total loss of 63 lives, and 1 was a roof fall that killed 5 men. In 1944, 4 major mine disasters resulted in a loss of 94 lives—22 in mine explosions and 72 in mine fires. In 1944 disasters occurred only in bituminous-coal mines.

Injury experience in 1945 was improved in each of the mineral-industry groups except metallurgical plants, where the safety record was slightly less favorable than in 1944. The improvement was greatest in the nonmetal-mining group, in which the frequency of injuries was reduced to 42.99 per million man-hours in 1945 from 50.47 in 1944. In the metal-mining group a substantial improvement was made, and the 1945 frequency of injuries was lowered to 51.04. However, this more favorable showing was effected in part by greatly increased activity at open-cut metal mines and lessened activity at underground mines. At quarries and coke plants, injury experience in 1945 was slightly improved over 1944, the rate of occurrence declining to 32.75 per million man-hours for quarries and 13.02 at coke plants. The slight betterment in the safety record at coal mines resulted from reductions in the rates of occurrence of fatal and nonfatal injuries in bituminous-coal mines and of fatal injuries at anthracite mines. These improved rates more than compensated for the slightly less favorable frequency rate of nonfatal injuries at anthracite mines. The combined rate of occurrence of fatal and nonfatal injuries at all coal mines was 66.77 per million man-hours in 1945 compared with a frequency of 67.12 in 1944.

GOVERNMENT STOCK-PILING ACTIVITIES

Stock-piling for war.—Subsequent to August 1943, Government stock-pile objectives for the emergency were gradually reduced as the supply situation and the outlook for successful conclusion of the war improved. In June 1945 Government-owned stock-pile goals were set at only 3 months' military requirements as established for the second quarter of 1945. Following VJ-day virtually all stock-pile objectives were abandoned, as controls on most raw materials were gradually removed. As of August 1, 1946, public purchasing for emergency purposes had been discontinued on all but a few minerals that were in short supply—antimony, tin, lead, copper, and corundum. Buying of these was geared to reconversion needs, and the building up or maintenance of emergency stocks was no longer part of the procurement program.

Surplus-property transfers.—Section 22 of the Surplus Property Act of 1944 (see Minerals Yearbook, 1944, p. 12), directed the transfer of the surplus stocks of strategic and critical materials on hand at the close of the war to the permanent military stock piles of the Government. However, the act also directed the Surplus Property Board to withhold such transfers to the extent that the War Production Board determined that available supplies were deficient for the current needs of industry over a 6-month period. Uncertainties as to future requirements and budgetary complications retarded action under the bill, so that as of August 1946 the addition of war surpluses to the permanent stock piles of the Government were relatively small in terms of ultimate objectives.

SPA Regulation 17, governing transfers under the act, was promulgated November 16, 1945. The transfer provisions of the Strategic and Critical Materials Stock-Piling Act, passed in July 1946, superseded those of the Surplus Property Act of 1944, and on August 16, 1946, the War Assets Administration issued revised regulations; these were printed in the Federal Register (vol. 11, No. 170, August 30, 1946, p. 9573).

Stock-pile legislation.—Late in 1945 and early in 1946 the Military Affairs Committees of the United States Senate and the House of Representatives conducted hearings on various stock-piling bills pending in Congress. On July 9, 1946, the Congress passed S. 752, entitled the "Strategic and Critical Materials Stock-Piling Act." The bill, which was approved by the President July 23, 1946, is designated as Public Law 520—79th Congress, Chapter 590—2d Session, and reads as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Act of June 7, 1939 (53 Stat. 811), as amended, is hereby amended to read as follows:

That the natural resources of the United States in certain strategic and critical materials being deficient or insufficiently developed to supply the industrial, military, and naval needs of the country for common defense, it is the policy of the Congress and the purpose and intent of this Act to provide for the acquisition and retention of stocks of these materials and to encourage the conservation and development of sources of these materials within the United States, and thereby decrease and prevent wherever possible a dangerous and costly dependence of the United States upon foreign nations for supplies of these materials in times of national emergency.

Sec. 2. (a) To effectuate the policy set forth in section 1 hereof the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior, acting jointly through the agency of the Army and Navy Munitions Board are hereby authorized and directed to determine, from time to time, which materials are strategic and critical under the provisions of this Act and to determine from time to time, the quality and quantities of such materials which shall be stock-piled under the provisions of this Act. In determining the materials which are strategic and critical and the quality and quantities of same to be acquired the Secretaries of State, Treasury, Agriculture, and Commerce shall each designate representatives to cooperate with the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior in carrying out the provisions of this Act.

(b) To the fullest extent practicable the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior, acting jointly, shall appoint industry advisory committees selected from the industries concerned with the materials to be stock-piled. It shall be the general function of the industry advisory committees to advise with the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior and with any agencies through which they may exercise any of their functions under this Act with respect to the purchase, sale, care, and handling of such materials. Members of the industry advisory committees shall receive a per diem allowance of not to exceed $10 for each day spent at conferences held upon the call of the Secretary of War, the Secretary of the Navy, and the Secretary of the Interior, plus necessary traveling and other expenses while so engaged.

Sec. 3. The Secretary of War and the Secretary of the Navy shall direct the Secretary of the Treasury, through the medium of the Procurement Division of his Department, to—

(a) make purchases of strategic and critical materials with due regard to the objectives set forth in section 1 of this Act and pursuant to the determinations as provided in section 2 hereof, which purchases (1) shall be made, so far as is practicable, from supplies of materials in excess of the current industrial demand and (2) shall be made in accordance with title III of the Act of March 3, 1933 (47 Stat. 1520), but may be made without regard to section 3709 of the Revised Statutes. A reasonable time (not to exceed one year) shall be allowed for production and delivery from domestic sources and in the case of any such material available in the United States but which has not been developed commercially, the Secretary of War and the Secretary of the Navy may, if they find that the production of such material is economically feasible, direct the purchase of such material without requiring the vendor to give bond;

(b) provide for the storage, security, and maintenance of strategic and critical materials for stock-piling purposes on military and naval reservations or other locations, approved by the Secretary of War and the Secretary of the Navy;

(c) provide through normal commercial channels for the refining or processing of any materials acquired or transferred under this Act when the Secretary of War and the Secretary of the Navy deem such action necessary to convert such materials into a form best suitable for stock piling, and such materials may be refined, processed, or otherwise beneficiated either before or after their transfer from the owning agency;

(d) provide for the rotation of any strategic and critical materials constituting a part of the stock pile where necessary to prevent deterioration by replacement of acquired stocks with equivalent quantities of substantially the same material with the approval of the Secretary of War and the Secretary of the Navy;

(e) dispose of any materials held pursuant to this Act which are no longer needed because of any revised determination made pursuant to section 2 of this Act, as hereinafter provided. No such disposition shall be made until six months after publication in the Federal Register and transmission of a notice of the proposed disposition to the Congress and to the Military Affairs Committee of each House thereof. Such notice shall state the reasons for such revised determination, the amounts of the materials proposed to be released, the plan of disposition proposed to be followed, and the date upon which the material is to become available for sale or transfer. The plan and date of disposition shall be fixed with due regard to the protection of the United States against avoidable loss on the sale or transfer of the material to be released and the protection of producers, processors, and consumers against avoidable disruption of their usual markets: *Provided*, That no material constituting a part of the stock piles may be disposed of without the express approval of the Congress except where the revised determination is by reason of obsolescence of that material for use in time of war. For the purposes of this paragraph a revised determination is by reason of obsolescence if such determination is on account of (1) deterioration, (2) development or discovery of a new or better material or materials, or (3) no further usefulness for use in time of war.

Sec. 4. The Secretary of War and the Secretary of the Navy shall submit to the Congress, not later than six months after the approval of this Act, and every six months thereafter a written report detailing the activities with respect to stock piling under this Act, including a statement of foreign and domestic purchases, and such other pertinent information on the administration of the Act as will enable the Congress to evaluate its administration and the need for amendments and related legislation.

Sec. 5. The stock piles shall consist of all such materials heretofore purchased or transferred to be held pursuant to this Act, or hereafter transferred pursuant to section 6 hereof, or hereafter purchased pursuant to section 3 hereof, and not disposed of pursuant to this Act. Except for the rotation to prevent deterioration and except for the disposal of any material pursuant to section 3 of this Act, materials acquired under this Act shall be released for use, sale, or other disposition only (a) on order of the President at any time when in his judgment such release is required for purposes of the common defense, or (b) in time of war or during a national emergency with respect to common defense proclaimed by the President, on order of such agency as may be designated by the President.

Sec. 6. (a) Pursuant to regulations issued by the War Assets Administration or its successor, every material determined to be strategic and critical pursuant to section 2 hereof, which is owned or contracted for by the United States or any agency thereof, including any material received from a foreign government under an agreement made pursuant to the Act of March 11, 1941 (55 Stat. 31), as amended, or other authority, shall be transferred by the owning agency, when determined by such agency to be surplus to its needs and responsibilities, to the stock piles established pursuant to this Act, so long as the amount of the stock pile for that material does not exceed the quantities determined therefor pursuant to section 2 hereof. There shall be exempt from this requirement such amount of any material as is necessary to make up any deficiency of the supply of such material for the current requirements of industry as determined by the Civilian Production Administration or its successor. There shall also be exempt from this requirement (1) any material which constitutes contractor inventory if the owning agency shall not have taken possession of such inventory, (2) such amount of any material as the Army and Navy Munitions Board determines (i) are held in lots so small as to make the transfer thereof economically impractical; or (ii) do not meet or cannot economically be converted to meet, stock-pile requirements determined in accordance with section 2 of this Act. The total material transferred to the stock piles established by this Act in accordance with this section during any fiscal year beginning more than twelve months after this Act becomes law shall not exceed in value (as determined by the Secretary of the Treasury on the basis of the fair market value at the time of each transfer) an amount to be fixed by the appropriation Act or Acts relating to the acquisition of materials under this Act.

(b) Any transfer made pursuant to this section shall be made without charge against or reimbursement from the funds available under this Act, except that expenses incident to such transfer may be paid or reimbursed from such funds, and except that, upon any such transfer from the Reconstruction Finance Corporation, or any corporation organized by virtue of the authority contained in the Act of January 22, 1932 (47 Stat. 5), the Secretary of the Treasury shall cancel notes of Reconstruction Finance Corporation, and sums due and unpaid upon or in connection with such notes at the time of such cancellation, in an amount equal to the fair market value as determined by the Secretary of the Treasury of the material so transferred.

(c) Effective whenever the Secretary of the Treasury shall cancel any notes pursuant to subsection (b) of this section, the amount of notes, debentures, bonds, or other such obligations which the Reconstruction Finance Corporation is authorized and empowered to have outstanding at any one time under the provisions of existing law shall be deemed to be reduced by the amount of the notes so canceled.

(d) Subsection (b) of section 14 of the Act of October 3, 1944 (58 Stat. 765), is hereby amended to read as follows:

(b) Subject only to subsection (c) of this section, any owning agency may dispose of—

(1) any property which is damaged or worn beyond economical repair;

(2) any waste, salvage, scrap, or other similar items;

(3) any product of industrial, research, agricultural, or livestock operations, or of any public works construction or maintenance project, carried on by such agency;

which does not consist of materials which are to be transferred in accordance with the Strategic and Critical Materials Stock Piling Act, to the stock piles established pursuant to that Act.

(e) Section 22 of the Act of October 3, 1944 (58 Stat. 765), is hereby repealed: Provided, That any owning agency as defined in that Act having control of materials that, when determined to be surplus are required to be transferred to the stock piles pursuant to subsection (a) hereof, shall make such determination as soon as such materials in fact become surplus to its needs and responsibilities.

Sec. 7. (a) The Secretary of the Interior, through the Director of the Bureau of Mines and the Director of Geological Survey, is hereby authorized and directed to make scientific, technologic, and economic investigations concerning the extent and mode of occurrence, and development, mining, preparation, treatment, and utilization of ores and other mineral substances found in the United States or its Territories or insular possessions, which are essential to the common defense or the industrial needs of the United States, and the quantities or grades of which are inadequate from known domestic sources, in order to determine and develop domestic sources of supply, to devise new methods for the treatment and utilization of lower grade reserves, and to develop substitutes for such essential ores and mineral products; on public lands and on privately owned lands, with the consent of the owner, to explore and demonstrate the extent and quality of deposits of such minerals, including core drilling, trenching, test-pitting, shaft sinking, drifting, cross-cutting, sampling, and metallurgical investigations and tests as may be necessary to determine the extent and quality of such deposits, the most suitable methods of mining and beneficiating them, and the cost at which the minerals or metals may be produced.

(b) The Secretary of Agriculture is hereby authorized and directed to make scientific, technologic, and economic investigations of the feasibility of developing domestic sources of supplies of any agricultural material or for using agricultural commodities for the manufacture of any material determined pursuant to section 2 of this Act to be strategic and critical or substitutes therefor.

Sec. 8. For the procurement, transportation, maintenance, rotation, storage, and refining or processing of the materials to be acquired under this Act, there is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, such sums as the Congress, from time to time, may deem necessary to carry out the provisions of this Act. The funds so appropriated, including the funds heretofore appropriated, shall remain available to carry out the purposes for which approppriated until expended, and shall be expended under the joint direction of the Secretary of War and the Secretary of the Navy.

Sec. 9. Any funds heretofore or hereafter received on account of sales or other dispositions of materials under the provisions of this Act, except funds received on account of the rotation of stocks, shall be covered into the Treasury as miscellaneous receipts.

Sec. 10. This Act may be cited as the "Strategic and Critical Materials Stock Piling Act."

The act is an amended version of the Strategic Materials Act of June 7, 1939. It authorizes the procurement of stocks of strategic and critical materials by purchase, by transfer of surplus war stocks owned by the United States Government, and by reverse lend-lease payments from foreign Governments. Except for rotation to prevent deterioration and disposal resulting from a revised determination of stock-pile quantities because of obsolescence of a material for use in time of war, the stock piles are frozen and can be released for use only in an emergency with respect to the common defense.

Section 7 (a) of the new bill directs the Secretary of the Interior, through the Directors of the Bureau of Mines and the Geological Survey, to make scientific, technologic, and economic investigations of domestic resources with a view to developing domestic sources of supply of those minerals which are essential to the common defense or the industrial needs of the United States but which are not produced in sufficient quantities to meet domestic requirements. This provision also was included in the act of 1939.

Section 7 (b) directs the Secretary of Agriculture to make similar studies of strategic and critical agricultural commodities; this provision was not included in the previous stock-piling act.

The old and new laws direct that purchases for the stock piles shall be made in accordance with the Buy American Act. In a message issued at the time he approved the bill, the President made the following statement regarding this provision of the law:

I have today signed the Strategic and Critical Materials Stock-Piling Act because it is important to the national interest that this Government have the power to acquire stock piles.

It is only because of the overriding importance of this purpose that I am able to overcome my reluctance to signing a bill which reaffirms the application to stock-pile purchases of the provisions of Title III of the Act of March 3, 1933 (47 Stat. 1520), known as the Buy American Act. These provisions will not only materially increase the cost of the proposed stock piles but will tend to defeat the conservation and strategic objectives of the bill by further depleting our already inadequate underground reserves of strategic materials. Furthermore, there can be a serious conflict between those provisions and the foreign economic policy which this Government is actively pursuing. It also seems to me that the application of the Buy American Act may frequently hamper the effective achievement of the essential purpose of the legislation which is to enlarge the stock of vital raw materials available within our borders in time of possible emergency.

The Buy American Act requires that only articles produced or manufactured from materials originating in the United States shall be purchased for public use. However, the Act also provides that exceptions to this rule may be made when Buy American purchases are determined "to be inconsistent with the public interest or the cost to be unreasonable." This provision clearly indicates that the stock-piling program should not be used as a means of generally subsidizing those domestic producers who otherwise could not compete successfully with other domestic or foreign producers. Furthermore, to insure that the necessary stock piles are accumulated as rapidly as deemed advisable and with a minimum cost to the public, this Act should not be used as a device to give domestic interests an advantage over foreign producers of strategic materials greater than that provided by the tariff laws.

It is the policy of this Government to work for international action to reduce trade barriers. We have proposed to other countries a set of principles governing trade, and look forward to the successful conclusion of broad international arrangements embodying the essential principles of these proposals. Pending the conclusion of such arrangements, it is the policy of this Government to avoid taking measures that will raise barriers to trade or prejudice the objectives of the forthcoming discussions. We are asking other countries to follow similar policies.

The United States is opposed to governmental policies fostering autarchy, for itself as well as for others. Encouragement of uneconomic domestic production and unjustified preferential treatment of domestic producers destroys trade and so undermines our national economic strength. A large volume of soundly based international trade is essential if we are to achieve prosperity in the United States, build a durable structure of world economy and attain our goal of world peace and security.

GOVERNMENT ORGANIZATION FOR WAR

Beginning with Minerals Yearbook, 1942, a brief summary has been presented under the foregoing heading of the Government agencies administering the war program with a view to preserving a chronological record of the major changes in organization and key personnel that affect the mineral industries. Similar summaries were presented in Minerals Yearbook, Review of 1940, and Minerals Yearbook, 1941, under the heading National Defense Activity. Minerals Yearbook, 1944, presented the record up to July 1945, and this review carries the record forward to July 1946. Details of the various actions taken by these agencies are given in the commodity chapters of this volume.

With the sudden cessation of World War II hostilities early in August 1945, the Government agencies faced the necessity for a rapid shift from production for war to reconversion for a peacetime economy. Plans had been made for reconversion, but they were based on a gradual transition to postwar operations. These circumstances involved many changes in the activities and personnel of the agencies during the latter half of 1945 and the first half of 1946, as well as termination of several of the agencies and the establishment of others. President Truman, on the surrender of Japan, called on the War Production Board to occupy a major role in "an orderly transition from war production to civilian production" and emphasized that WPB's controls "should be lifted as soon as they are no longer needed." In line with this public statement of the President, WPB began at once to remove its individual controls over industry and by August 20 had only 130 industry regulatory orders in effect compared with a wartime peak of more than 600 such orders.

Development of the atomic bomb and its use in bringing about an abrupt end to the war with Japan were followed by the issuance of an Executive order dated September 13, 1945, withdrawing and reserving for the use of the United States lands on the public domain containing radioactive mineral substances. Proposed legislation providing for the control of atomic energy was soon thereafter introduced in Congress, and scientific, military, industrial, and Government representatives were called upon to present their views before the Senate committee appointed to prepare the enabling bill. On June 1, 1946, the Senate passed the Atomic Energy Control Bill, S. 1717, which, however, was not destined to be signed by the President until August 5, 1946. The bill, as finally passed by the Congress and approved by the President, created a civilian commission for the control and development of atomic energy in the United States.

In September 1945 the Foreign Economic Administration was abolished by Executive order, and the functions of that agency were divided among the State, Commerce, and Agriculture Departments and the Reconstruction Finance Corporation. Announcement was made early in October 1945 that the War Production Board would be terminated on November 3 and that all its activities were to be transferred to a new agency, the Civilian Production Administration. The resignation of WPB chairman J. A. Krug was accepted by the President, effective with termination of the agency, and J. D. Small, Chief of Staff of WPB, was designated Administrator of CPA. Following the resignation in February 1946 of Harold L. Ickes as Secretary of the Interior, Krug was selected by the President for that cabinet post; the appointment was confirmed by the Senate early in March.

John R. Steelman, the administration's top labor consultant, was appointed in June 1946 to succeed John W. Snyder as Director of the Office of War Mobilization and Reconversion when the latter assumed the post of Secretary of the Treasury, vice Fred M. Vinson, who had been elevated to Chief Justice of the Supreme Court. In February 1946 a new agency, the War Assets Administration, with Lt. Gen. Edmund H. Gregory, Quartermaster General of the Army, as Administrator, took over disposal of surplus war property from the Surplus Property Board. Gen. Gregory was succeeded as Administrator in July 1946 by Maj. Gen. Robert M. Littlejohn.

Other recent developments include the passage and approval of the bill extending the life of the Office of Price Administration for 1 year and establishing a three-man Price Decontrol Board; placement of the Office of Economic Stabilization under the Office of War Mobilization and Reconversion; and the appointment of the members of the new Economic Advisory Council, the function of which three-man council is to study the economy of the Nation and make reports and recommendations to Congress and the President. Other changes in the organizations chiefly concerned with the mineral activities of the war program are recorded below.

War Production Board, Civilian Production Administration.—At the close of the war in the Far East, the functions of the War Production Board became wholly those of directing and guiding the United States toward orderly reconversion to peacetime activities, to be achieved as rapidly as possible. With this end in view, the year from July 1, 1945, to July 1, 1946, saw many changes in organization and personnel.

On October 4, 1945, the War Production Board was terminated, effective November 3, 1945. The residual functions were transferred to the Civilian Production Administration. On dissolution of the War Production Board, J. A. Krug resigned as Chairman, and J. D. Small, formerly Chief of Staff of WPB, became Administrator of Civilian Production Administration, with Philip Maguire as Deputy Administrator. At that time, in addition to the Administrator and

Deputy Administrator, Small announced the following organization and personnel of the Civilian Production Administration:

1. Bureau of Reconversion Operations; Director, Fred Glover. This bureau contains all the industry divisions, including Metals and Minerals, Rubber, Equipment, Forest Products, Textiles, Chemicals, Construction, and Consumers Hard Goods.
2. Bureau of Field Operations; Director, C. A. Woodruff.
3. Bureau of International Supply; Director, Robert Turner. This bureau has charge of exports, imports, and international supply. The Combined Boards, through which the United States, Great Britain, and Canada coordinated activities in shipping, food supply, and allocation of raw materials during the war, were under its jurisdiction until they disbanded at the end of the year.
4. Bureau of Reconversion Priorities; Director, Lincoln Gordon. General administration of priorities, allocations, regulations, inventory, compliance, and such controls as are required came under the functions of this bureau.
5. Bureau of Demobilization; Director, G. Lyle Belsley.
6. Office of General Counsel; General Counsel, L. M. Lombard.
7. Review and Analysis Staff; Director, Robert Turner.
8. Office of Labor Requirements; Director, Ralph Hetzel.
9. Information Division; Director, Maxey Morrison.

In the organization of the Civilian Production Administration, the Office of Vice Chairman for Metals and Minerals under the War Production Board became the Metals and Minerals Division. Before this transition, James Douglas resigned as Deputy Vice Chairman for Metals and Minerals on August 31, 1945. He was succeeded by F. H. Hayes, formerly Assistant Director of the Copper Division. With the advent of the CPA on November 3, R. C. Allen resigned as Vice Chairman, and Hayes became Director of the Metals and Minerals Division. At the same time, Roland D. Parks, who had been Assistant Deputy Director of Metals and Minerals Production, became Deputy Director. Parks returned to private employment in February 1946, and in May 1946 John J. Croston, Assistant Chief of the Tin, Lead, and Zinc Branch, succeeded him as Deputy Director. The Mineral Classification Committee and the Minerals and Metals Advisory Committee were disbanded, while the Mineral Resources Operating Committee continued on a "stand-by" basis, to function as needed.

On August 20, 1945, immediately following VJ-day, the War Production Board canceled 210 of 340 industry regulatory orders. On VJ-day 53 of these orders were handled by the Metals and Minerals organization. Orders were canceled as the need for them disappeared, so that on July 1, 1946, the Metals and Minerals Division had only 7 in effect, dealing with steel, tin, lead, antimony, and uranium. As reconversion progressed, the number of personnel was likewise reduced. On July 1, 1945, the Metals and Minerals organization totaled 616 employees. This number was reduced to 144 by November 3, when the War Production Board was terminated, and to 128 by July 1, 1946.

Membership in the Premium Price Quota Committee remained unchanged. In May 1946 John J. Croston took over the chairmanship, when he became Deputy Director of Metals and Minerals. Landon F. Strobel remained as secretary.

N. H. Bell resigned as Director of the Aluminum and Magnesium Division on September 1, 1945. A. B. Menefee assumed the duties as Director but left at the end of October. He was succeeded by R. L. Sebastian.

Michael Schwarz resigned as Director of the Copper Division at the end of September 1945. He was followed by J. J. Hines, Jr., who remained until the end of the year, when D. L. Forrester took over.

On October 2, 1945, Arthur S. Knoizen left the Mining Division, and Marcellus H. Stow became Director. At the end of the year, Stow resigned and his duties were taken over by Harold Montag. June 24, 1946, Montag resigned, and at that time the Mining Branch was combined with the Miscellaneous Minerals Branch under F. G. Rockwell.

When the War Production Board was terminated, November 3, 1945, W. B. Todd resigned as Director of the Steel Branch. His duties were taken over by P. J. Treacy.

Erwin Vogelsang continued as Chief of the Tin, Lead, and Zinc Branch.

As of July 1946, the members of the Civilian Production Administration dealing with policy or administration affecting the mineral industries were as follows:

Administrator	John D. Small.
Deputy Administrator	Philip F. Maguire.
Deputy Administrator	John C. Houston, Jr.
General Counsel	Harold L. Price.
Office of Labor Requirements, Director	Ralph Hetzel.
Review and Analysis Staff, Director	Robert E. Johnson.
Information Division, Director	Karl Keyerleber.
Bureau of Industry Operations, Director	Fred Glover.
Metals and Minerals Division, Director	F. H. Hayes.
Deputy Director	John J. Croston.
Premium Price Quota Committee:	
Chairman	John J. Croston.
Secretary	Landon F. Strobel.
Civilian Production Administration, Tin, Lead, and Zinc Branch.	C. A. Wright.
Civilian Production Administration, Tin, Lead, and Zinc Branch.	Edgar E. Barker.
Civilian Production Administration, Copper Branch.	P. B. Blakemore.
Office of Price Administration	Jesse L. Maury.
Office of Price Administration	J. J. Beeson.
Office of Price Administration	C. O. Mittendorf.
Tin, Lead, and Zinc Branch, Chief	E. Vogelsang.
Deputy Chief	S. K. Butterworth.
Cork, Asbestos, and Fibrous Glass Branch, Chief	Ray H. Coultrap.
Aluminum and Magnesium Branch, Chief	Robert L. Sebastian.
Copper Branch, Chief	D. L. Forrester.
Miscellaneous Minerals and Mining Branch, Chief	F. G. Rockwell.
Steel Branch, Chief	P. J. Treacy.
Deputy Chief	Charles Halcomb.

Office of Price Administration.—Price controls over most minerals remained in effect throughout the period January 1, 1945, to July 1, 1946, although steps were taken to decontrol such items as aluminum, aluminum mill products, and many ferro-alloys. Where controls remained, however, increasing costs and other factors characteristic of the transition from a wartime to a peacetime economy led the OPA, in applying its standards of price action, to permit a number of price increases. Prices of coal, iron ore, pig iron, and basic steel products were increased in amounts ranging from 3 to 8 percent. The Premium

Price Plan for copper, lead, and zinc continued in operation, although at the close of the period increases of about 20 percent and 25 percent, respectively, were permitted in the base maximum prices of copper and lead, to offset some of the increased costs resulting from wage increases in the mining industry, and to restore base period earnings.

As of July 1, 1946, the following officials had chief responsibility for price actions in the field of minerals:

Industrials Price Division, Director	Frederick C. Holder.
Metals Price Branch, Price Executive	Warren M. Huff.
Metals Mining Analysis Office, Director	Jesse L. Maury.
Rubber, Chemicals, and Drug Price Branch, Acting Price Executive	George W. Strasser.
Building and Construction Price Division, Director	Gordon Rieley.
Building Materials Price Branch, Price Executive	Julian Littau.

Petroleum Administration for War.—In the early months of 1945 demand on the United States for all oils reached record levels and taxed the facilities of the Petroleum Administration and the petroleum industry to meet, world-wide, the urgent needs of the United Nations in the final stages of the war. With the surrender of Germany in May, a major problem of coordination of supply and transportation of petroleum and products was posed by the shift in emphasis from the European to the Asiatic theater of military operations. It was necessary to curtail the eastward movement and to direct all available means to augment the rapid flow of products westward to the Pacific through the Panama Canal and overland through West coast ports until the surrender of Japan in August.

As had been frequently promised during the war, prompt action was taken to remove controls over the petroleum industry upon the end of hostilities. The day after the surrender of Japan, August 15, 1945, rationing of gasoline and fuel oils was ended, and wartime restrictions upon gasoline quality and most refining operations were removed. On August 23 most of the distribution and marketing regulations were rescinded. Many of the controls over petroleum supply and transportation were canceled on August 27, and regulations covering well spacing in the oil and natural-gas fields expired on September 1, as did limitations on construction in all branches of the industry. By October 15 all domestic orders had been terminated, and those affecting foreign operations became void by November 1.

By the end of 1945, six of the Division directors had resigned and the Washington staff had been reduced to 161 from 665 on August 1 and from a wartime peak before VE-day of 1,438. By April 1, 1946, the remaining Division directors had resigned and the staff numbered 58. The Administration's field staff, which had totaled 313 on August 1, 1945, was eliminated by April 1, 1946.

By Executive order of the President the Petroleum Administration for War was terminated, effective May 8, 1946. Shortly thereafter, however, a new Oil and Gas Division was organized in the Department of the Interior to undertake a program, recommended by the President, of coordination of Government activities with respect to petroleum and natural gas and to serve as a liaison agency of the Federal Government in its relations with appropriate State bodies and the petroleum industry.

Solid Fuels Administration for War.—The 1945 activities continued the agency's policy of encouraging the maximum production of coal, of requiring an equitable distribution of available supplies, and of educating consumers in methods of conservation. To augment the shortage of Southern Appalachian and other high-grade coals, SFAW encouraged the substitution, in part, of lower-grade solid fuels, especially run-of-mine sizes and reclaimed coke.

Special efforts were made to supply the Great Lakes docks before the close of the navigation season. This cut the Southeast short during the summer and fall, and, as soon as the lakes froze over, the deficiency in the Southeast was made up by special directives.

After the surrender of Japan the conservation campaign was dropped, and the regulations were modified as rapidly as possible, although the more important types of coal continued in short supply. As coal produced west of the Mississippi River began to meet requirements, all controls in that area were eased. By August 1945 restrictions on shipments of reclaimed coke to Canada were lifted; by September, controls over deliveries by retail dealers were revoked. In October most of the wartime restrictions on producers' and wholesalers' shipments of anthracite and coke to retail dealers were lifted. Scarcity of special purpose and other Southern Appalachian coals continued, and their distribution had to be further restricted.

Because of the serious manpower shortage, efforts were made throughout the war to have miners released from the draft. After the war, demobilization of experienced miners occurred too slowly to relieve the shortage during the winter. By the end of the fuel year, March 31, 1946, most of the remaining regulations and orders had been revoked, except for reporting to SFAW on production and distribution. At that time, SFAW was planning to liquidate at the end of the fiscal year. There followed the long strike in the soft-coal mines, necessitating a freezing order of coal on mine track, the issuance of an interim directive to provide for the emergency, and later a new regulation on soft-coal distribution.

With the fall of Germany, the demand for coal for the liberated nations of Europe placed a heavy responsibility upon SFAW. Only coal that was surplus, principally strip-mined coal, run-of-mine sizes and low-grade, could be released for export without upsetting the national economy. The rapid increase of strip mining during the war provided enough soft coal of usable quality to warrant a large export program, but care had to be taken that only usable coal was carried to the ports, and the compliance activities of SFAW in this field were increased.

In April 1945, the Government, by Executive order, again took over the soft-coal mines, because the miners failed to return to work under the new Government-approved contract between the coal operators and the United Mine Workers of America. In May, a break-down in anthracite wage negotiations threatened a fuel crisis, and the Government temporarily took over the hard-coal mines. SFAW carried out the take-overs as it had done several times during the war. By the end of the summer all the mines had been returned to their owners. In April and May 1946, during the long strike, the Government again took over the soft-coal mines, setting up a new Coal Mines Administration in the Department of the Interior. SFAW was called upon to assist the new agency, utilizing its wartime experience and records.

As of August 1, 1946, the organization and the executive heads of principal units of the Solid Fuels Administration for War were as follows:

Administrator	J. A. Krug.
Deputy Administrator	Dan H. Wheeler.
Assistant Deputy Administrator	Harlen M. Chapman.
Assistant Deputy Administrator (heads Bituminous Distribution Division).	Walter P. Neekamp.
Assistant Deputy Administrator	E. Boykin Hartley.
Assistant Deputy Administrator (heads Anthracite Distribution Division).	Thomas G. Valleau.
General Counsel (heads Legal and Compliance Divisions)	Thomas J. O'Brien.
Anthracite Distribution Division	Thomas G. Valleau.
Bituminous Distribution Division	Walter P. Neekamp.
Legal Division	Thomas J. O'Brien.
Compliance Division	Thomas J. O'Brien.
Production, Conservation and Information Division	William J. Dougherty.
Field Office Division	N. W. Wood, Jr.
Budget and Administrative Services Division	Mabel S. Bush.
Personnel Division	Julia Carpin.

Foreign Economic Administration.—The origin and functions of this agency were described briefly in Minerals Yearbook, 1944.

An Executive order issued in September 1945 abolished the agency and provided for the division of its functions among the State, Commerce, and Agriculture Departments and the Reconstruction Finance Corporation. Resignation of the Director, Leo T. Crowley, was accepted, effective October 15.

The State Department took over administration of lend-lease, United States participation in the United Nations Relief and Rehabilitation Administration, and the purchasing of certain strategic materials in liberated areas. It was also made the disposal agency for all surplus property, except certain vessels, in foreign areas.

Reconstruction Finance Corporation took over the United States Commercial Company, including its functions in the procurement of strategic commodities abroad, and also the Petroleum Reserve Corporation and the Rubber Development Corporation.

The Department of Commerce took over export controls, technical industrial intelligence, facilitation of trade, and the functions of the clearing office for foreign transactions and reports.

Programs dealing with food and food machinery were taken over by the Department of Agriculture.

The Foreign Economic Administration operated through two major bureaus—a Bureau of Supplies, of which Sidney H. Scheuer was Executive Director, and a Bureau of Areas, directed by Arthur Paul. Foreign procurement of commodities was carried on in a Foreign Procurement and Development Branch, of which Arthur Z. Gardiner was Director and Alan M. Bateman Associate Director. Actual operations in the foreign minerals procurement and development fields were conducted by the Metals and Minerals Divisions of that Branch. Key officials on the technical staffs of these two Divisions and of the associated Technical Services Division were as follows just prior to the abolishment of FEA:

Director of Metals and Minerals	Alan M. Bateman.
Metals Division, Chief	Mahlon M. Miller.
Copper Section, Chief	William C. Schmidt.
Zinc-Lead Section, Chief	F. R. McIntosh.
Tin, Mercury, Antimony, Bauxite Section, Chief	Clarence E. Peterson.
Ferro-Alloy Section, Chief	Cayford Burrell.
Scrap Metals Section, Chief	Benjamin Schwartz.
Minerals Division, Chief	Hugh E. McKinstry.
Mica-Graphite Section, Chief	Richard H. Vail.
Quartz and Abrasives Section, Chief	Carl Tolman.
Alloy and Rare Minerals Section, Chief	Robert W. Bridgeman.
Engineering Analysis and Contract Control Section, Chief	Robert K. Warner.
Service and Supply Section, Chief	Marshall Walker.
Administrative Section, Chief	Alfred Wilson.

Reconstruction Finance Corporation.—This agency has had a tremendous part in carrying out the defense and war programs on the industrial front, including the construction and management of mineral processing plants and the procurement of strategic and critical minerals. Its activities up to July 1, 1945, were described briefly in Minerals Yearbook, 1944. As of May 31, 1946, authorizations for RFC activities, including direct commitments for war purposes of approximately $2,900,000,000, have amounted to $37,600,000,000. Disbursements have exceeded $23,800,000,000, including $3,177,841,000 for direct subsidy payments to increase or maintain production of strategic or critical materials. The latter figure does not include losses arising from the purchase and sale of such materials.

As of July 1, 1946, Charles B. Henderson, Chairman of the Board of Directors of the Reconstruction Finance Corporation, was serving also as Acting Federal Loan Administrator.

Office of Metals Reserve

A substantial part of the war procurement and disposition of strategic and critical metals and minerals was conducted by Metals Reserve Company until July 1, 1945, when, under Public Law 109, 79th Congress, it was consolidated with the Reconstruction Finance Corporation. Activity continued through 1945 for war and reconversion needs and is expected to last through 1946 in order to meet the civilian deficiencies as estimated by Civilian Production Administration. Total purchase commitments as of May 31, 1946, exclusive of approximately $2,200,000,000 canceled or assigned to the Foreign Economic Administration, aggregated $3,581,342,000, of which $2,360,022,000 has been disbursed. Sales of materials, principally to war industries, have totaled $1,945,268,000. Strategic metals and minerals transferred to Treasury Procurement to become part of the permanent stock pile amounted to $109,001,000. Inventories on hand reflect a total cost of $587,448,000, not including such assets as advances to contractors and other receivables and mining supplies and equipment currently in use.

Reconstruction Finance Corporation, through its Office of Metals Reserve, also operates the tin smelter at Texas City and the Nicaro nickel plant in Cuba and operates the Premium Price Plan for domestic copper, lead, and zinc.

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The following, by virtue of appointment by the Board of Directors of RFC, direct the activities of the Office of Metals Reserve:

Morris Levinson, Executive Director; Jesse C. Johnson, Deputy Director; George S. Jewett, Deputy Director; S. P. Petterson, Deputy Director; R. E. Leahy, Assistant Director; G. W. Brodie, Assistant Director; J. F. Morse, Jr., Traffic Manager.

OFFICE OF DEFENSE PLANTS

Expansion of industrial plant capacity and plants for the production of munitions and strategic or critical materials required for the successful prosecution of World War II was, to a considerable extent, conducted through this agency. Total expenditures through May 31, 1946, for war plants, facilities, and machine tools were $7,433,589,850. (This includes 45 plants transferred to Office of Rubber Reserve, for which a total of $669,175,000 had been disbursed.) An additional $100,000,000 has been authorized and is pending cancellation settlements.

The expenditures involved the complete construction of 537 general-purpose plants, 529 special-purpose plants, 27 housing projects, and [illegible] scrambled facilities—a total of 1,164 wholly owned projects, including land, buildings, and equipment costing $6,583,000,000. In addition, the Corporation provided machinery and equipment valued at $692,626,000 to 1,185 plants owned by other operators. Commitments for the production of critical and strategic materials in foreign countries totaled $57,589,850.

The following, by virtue of appointment by the Board of Directors of RFC, direct the activities of the Office of Defense Plants:

Frank T. Ronan, Executive Director; James L. Kelehan, Associate Director; H. R. Rutland, Deputy Director in Charge of Plant Servicing Division; William J. Hickey, Assistant Director in Charge of Real Estate and Taxation Section; A. W. Greely, Deputy Director in Charge of Engineering Division; Leo Nielson, Assistant Director; John F. Williams, Assistant Director in Charge of Sales; James G. Boss, Chief Counsel; Fred Warren, Assistant Director in Charge of Accountability; Austin Roe, Assistant Director in Charge of Contract Termination Section.

OFFICE OF DEFENSE SUPPLIES

Although this agency has been concerned chiefly with products other than minerals, it has had some important functions related to the mineral industries. Its operations have included the purchase of strategic and critical materials, the payment of extraordinary transportation costs on oil, coal, and sugar, and various other activities such as the making of loans and the payment of subsidies in connection with the purchase of materials. Disbursements for such purposes, as of January 1, 1946, were $8,100,000,000. Receipts from the sale of materials, repayment of loans, and other sources amounted to $6,100,000,000. Total expenditures authorized by Defense Supplies aggregated $12,300,000,000, of which $1,400,000,000 had been canceled or assumed by private industry.

The following, by virtue of appointment by the Board of Directors of RFC, direct the activities of the Office of Defense Supplies:

Stuart K. Barnes, Executive Director; George B. Stoner, Associate Director; Henry D. Brite, Deputy Director, Petroleum and Chemicals; Charles A. Jostes, Deputy Director, Materials and Supplies; Irving M. Griffin, Assistant Director, Traffic Division.

STATISTICAL SUMMARY OF MINERAL PRODUCTION

(GENERAL UNITED STATES SUMMARY AND DETAILED PRODUCTION BY STATES)

By Marian E. Meyer

SUMMARY OUTLINE

INTRODUCTION

This report continues the series of annual statistical summaries published in previous years as chapters of Mineral Resources and Minerals Yearbook.

In order to meet the need of industry and the States for up-to-date statistics on State production of minerals, State summaries are presented for the current year. Because of the early date of publication, the fuel figures for 1945 are estimates subject to revision; it is believed, however, that the data shown represent a high order of accuracy.

UNIT OF MEASUREMENT

The unit of measurement used by the Bureau of Mines for each mineral product in reports on the mineral resources is that common to the industry concerned, and the variation in these units makes it impracticable, if not impossible, directly to combine and compare the different minerals except as to value. Although most of the products are measured by weight, some are measured by volume and some by number of "pieces," etc.; for some no total quantity figures are available.

ELIMINATION OF DUPLICATION

In the totals for the United States, shown in the following "general" tables, duplication has been eliminated wherever practicable, and in the State totals given in the State tables virtually all duplication has been eliminated. For instance, in both general and State tables the output of coke is shown but its value is not included in the totals, as the value of the coal used in its manufacture enters into the value of the coal production which is included in the totals. For asphalt, both native and oil are shown in the general tables, but the value of the oil asphalt is excluded from the totals as it duplicates that of the petroleum from which it is manufactured. For the clay industries, for years before 1936, the total value of clay products is included in both general and State totals as representing the first marketable form of the greater part of the clay produced; the quantity and value of the clay mined and sold in the raw state by miners to users of clay are shown separately also, but the value is not included in the totals as it is duplicated largely in that for clay products. For the years 1936 through 1944, the value of clay sold or shipped by producers and of clay products other than pottery and refractories are included in the United States and State totals. For 1945, total production of clay, as represented by clay sold or used, is given; but the value of clay used in heavy-clay products and in cement is omitted from the totals, as it is duplicated in the values for clay products other than pottery and refractories and for cement, both of which are included in the totals. These changes in practice should be borne in mind when comparing earlier years.

United States totals.—In the general tables both iron ore and pig iron are shown, but the value of the pig iron rather than the iron ore is included in the United States totals, as that is considered the better means of presenting the statistics for iron in its first marketable form. For gold, silver, copper, lead, and zinc the value of "smelter output" is included in the general totals, and to account more fully for the value of the ores treated these smelter figures are supplemented by the value of the byproduct sulfuric acid. The value of pigments (white lead, red lead, lithopone, litharge, and orange mineral) manufactured from metals is not included in the general tables, as the base from which they are made is included in the output of lead or zinc, whereas the value of sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide is included, as these are made in large part direct from the ores and do not enter into the lead or zinc totals, which represent smelter output.

State totals.—In the State tables also iron ore and pig iron are both shown. As blast-furnace products cannot be traced to the States in which the ore is mined, the value of the ore is used in the State totals. For ores of gold, silver, copper, lead, and zinc no values are shown, and in fact none are recorded; instead, for each of these metals the recoverable content of the ores is used as the basis of valuation. The value of the zinc and lead pigments is not included in the State total, as the recoverable zinc and lead content of the ores from which the products were made is included under zinc or lead. The value of the sulfuric acid produced as a byproduct of copper, lead, and zinc smelting and zinc roasting is not included in the State total, as tracing this product back to the State producing the ore has not been possible.

GENERAL TABLES

Mineral products of the United States, 1943–45 [1]

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
METALLIC						
Aluminum .... short tons (2,000 pounds)	920,179	$265,380,000	776,446	$222,416,000	496,487	$141,924,000
Antimonial lead .... do	[2] 63,515	(2)	[2] 57,902	(2)	[2] 56,495	(2)
Antimony:						
Metal .... do	(3)	(3)	(3)	(3)	(3)	(3)
Ore and concentrates .... do	16,785	913,576	13,501	563,296	14,966	561,630
Bauxite [4] .... long tons (2,240 pounds)	6,693,080	32,744,109	2,823,724	14,402,497	981,372	5,631,335
Beryllium ore .... short tons	356	44,407	388	56,135	39	6,133
Cadmium:						
Metal .... pounds	8,326,768	6,570,546	8,551,424	6,435,124	7,938,658	6,106,992
In compounds .... do	137,952	108,844	285,203	213,902	451,050	347,308
Chromite .... short tons	160,120	4,820,461	45,629	1,668,299	13,973	532,382
Copper [5], sales value .... do	1,092,939	[6] 257,934,000	1,003,379	[6] 236,797,000	782,726	[6] 184,723,000
Ferro-alloys .... do	1,995,171	271,487,609	1,860,956	246,014,039	1,661,657	210,509,657
Gold [7] .... troy ounces	1,394,522	48,808,270	1,022,238	35,778,330	928,893	32,511,255
Iron:						
Ore [8] .... long tons	99,462,850	[8] 269,016,546	95,135,675	[8] 256,885,512	88,136,715	[8] 243,760,986
Pig .... short tons	60,787,159	1,273,634,210	60,995,977	1,278,981,313	53,265,353	1,172,435,165
Lead (refined),[5] sales value .... do	406,544	[6] 52,038,000	394,443	[6] 50,489,000	356,535	[6] 45,636,000
Magnesium (new ingot) .... do	170,267	69,960,802	146,585	60,141,437	43,496	17,874,418
Manganese ore (35 percent or more Mn) .... do	205,173	7,278,758	247,616	9,014,875	182,337	7,320,309
Manganiferous ore (5 to 35 percent Mn) .... do	1,722,868	4,522,052	1,487,612	3,855,946	1,522,854	3,513,666
Mercury:						
Metal .... flasks (76 pounds net)	51,929	10,137,060	37,688	4,460,752	30,763	4,149,621
Ore .... short tons	(9)	(10)	(9)	(10)	(9)	(10)
Molybdenum .... pounds	53,955,000	38,500,000	39,423,000	27,999,000	32,524,000	23,107,000
Nickel .... short tons	642	(11)	988	(11)	1,155	(11)
Ores (crude), old tailings, etc.:						
Copper .... do	98,120,000	(10)	91,064,000	(10)	76,856,000	(10)
Dry and siliceous (gold and silver) .... do	4,963,000	(10)	2,620,000	(10)	1,984,000	(10)
Lead .... do	7,258,000	(10)	6,805,000	(10)	6,730,000	(10)
Lead-copper .... do	400	(10)	123,000	(10)	168,000	(10)
Zinc .... do	16,804,000	(10)	16,470,000	(10)	16,308,000	(10)
Zinc-copper .... do	813,000	(10)	943,000	(10)	812,000	(10)
Zinc-lead .... do	13,403,000	(10)	15,418,000	(10)	12,355,000	(10)
Zinc-lead-copper .... do	27,000	(10)	19,000	(10)	12,000	(10)
Platinum metals (refined) (value at New York City) .... troy ounces	34,917	1,455,000	33,021	1,481,000	33,592	1,543,000

See footnotes at end of table.

Mineral products of the United States, 1943–45 [1]—Continued

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
METALLIC—continued						
Selenium ... pounds	521, 779	(11)	423, 906	(11)	666, 363	(11)
Silver [12] ... troy ounces	40, 900, 121	$29, 084, 530	35, 651, 049	$25, 351, 855	29, 063, 255	$20, 667, 205
Tantalum and columbium ores ... pounds	15, 182	29, 086	10, 412	24, 234	6, 649	13, 653
Tellurium ... do	62, 260	(11)	45, 323	(11)	60, 328	(11)
Tin (metallic equivalent) ... short tons	7	6, 800	6	6, 200		
Titanium concentrates:						
Ilmenite ... do	211, 715	3, 738, 970	280, 791	7, 371, 279	308, 518	7, 359, 170
Rutile ... do	3, 941	610, 879	6, 770	1, 088, 112	6, 837	869, 920
Tungsten ore (60-percent concentrates) ... do	11, 945	17, 973, 685	10, 283	14, 407, 143	5, 715	7, 957, 731
Vanadium ... pounds	5, 586, 492	3, 518, 493	3, 527, 054	1, 689, 578	2, 963, 913	1, 766, 500
Zinc,[5] sales value ... short tons	594, 250	[6] 102, 211, 000	574, 453	[6] 98, 806, 000	467, 084	[6] 80, 338, 000
Other metallic [13]		2, 506, 443		2, 576, 048		2, 961, 690
Total value of metallic products (approximate)		2, 488, 000, 000		2, 340, 000, 000		1, 975, 000, 000
NONMETALLIC						
Arsenious oxide ... short tons	32, 423	1, 519, 706	34, 472	1, 696, 819	24, 810	1, 197, 061
Asbestos ... do	6, 014	334, 815	6, 667	380, 334	12, 226	417, 348
Asphalt:						
Native ... do	886, 135	4, 288, 488	789, 516	3, 691, 279	703, 873	3, 816, 471
Oil (including road oil) [8] ... do	7, 131, 973	[8] 80, 615, 217	6, 408, 766	[8] 70, 310, 623	6, 311, 815	[8] 68, 930, 149
Barite (crude) ... do	420, 343	2, 796, 776	518, 617	3, 558, 489	696, 062	5, 348, 652
Boron minerals ... do	256, 633	6, 401, 507	277, 586	6, 579, 587	325, 935	7, 635, 365
Bromine ... pounds	94, 085, 937	19, 107, 065	102, 112, 462	19, 712, 819	79, 709, 857	14, 796, 229
Calcium-magnesium chloride ... short tons	199, 796	1, 549, 565	200, 964	1, 621, 227	218, 320	1, 818, 219
Cement ... barrels (376 pounds net)	129, 478, 662	202, 460, 328	95, 592, 155	151, 996, 646	107, 833, 108	175, 430, 858
Clay:						
Products (other than pottery and refractories)		[14] 75, 200, 000		[14] 65, 472, 000		[14] 86, 275, 352
Raw ... short tons	[15] 7, 287, 897	[15] 24, 915, 007	[15] 6, 275, 140	[15] 23, 524, 998	[15] 18, 627, 607	[15] 39, 795, 315
Coal:						
Bituminous [16] ... do	590, 177, 069	1, 584, 644, 477	619, 576, 240	1, 810, 900, 542	576, 000, 000	1, 777, 336, 000
Pennsylvania anthracite ... do	60, 643, 620	306, 816, 018	63, 701, 363	354, 582, 884	54, 933, 909	323, 944, 435
Coke [8] ... do	71, 676, 063	[8] 476, 117, 472	74, 037, 817	[8] 527, 921, 506	67, 308, 181	[8] 508, 540, 042
Diatomite ... do	(17)	(17)	(17)	(17)	(17)	(17)
Emery ... do	6, 666	63, 195	6, 940	64, 858	7, 856	75, 977
Feldspar (crude) ... long tons	308, 180	1, 646, 277	327, 408	1, 813, 937	373, 054	2, 021, 529
Fluorspar ... short tons	406, 016	11, 802, 255	413, 781	12, 503, 487	323, 961	9, 896, 879
Fuller's earth ... do	247, 258	2, 664, 027	294, 737	3, 297, 064	296, 368	3, 463, 913
Garnet for abrasive purposes ... do	5, 935	429, 120	(17)	(17)	6, 306	375, 198
Gems and precious stones		(18)		(18)		(18)

Graphite:						
Amorphous / Crystalline ... short tons	9,597	903,102	5,768	349,663	5,334	289,207
Grindstones and pulpstones ... do	12,623	488,205	(17)	(17)	(17)	(17)
Gypsum (crude) ... do	3,877,541	5,959,615	3,761,234	6,450,767	3,811,723	6,984,324
Helium [19] ... cubic feet	58,951,160	321,213	137,268,144	872,551	128,440,909	937,283
Iodine ... pounds	(17)	(17)	(17)	(17)	(17)	(17)
Kyanite ... short tons	9,561	238,649	(17)	(17)	(17)	(17)
Lime ... do	6,596,615	49,064,328	6,473,563	48,698,162	5,920,579	45,918,468
Lithium minerals ... do	8,155	314,660	13,319	552,977	2,446	285,520
Magnesite (crude) ... do	754,832	6,071,596	561,450	4,407,461	336,458	2,324,957
Magnesium compounds (natural) (including brucite) ... pounds	1,225,148,000	21,605,241	1,023,158,000	18,393,960	539,612,000	9,675,149
Marl:						
Calcareous ... short tons	147,153	152,821	178,036	171,599	154,122	188,311
Greensand ... do	10,056	522,124	4,908	505,651	4,986	477,919
Mica:						
Scrap ... do	46,138	738,025	51,727	1,089,072	32,880	509,600
Sheet ... pounds	3,448,199	3,228,742	1,523,313	3,262,711	1,298,587	737,342
Millstones	----------	9,240	----------	9,700	----------	15,018
Mineral pigments:						
Natural pigments and manufactured iron oxide pigments ... short tons	100,216	7,951,057	97,018	8,016,452	101,014	8,825,174
Zinc and lead pigments [20] ... do	192,827	26,340,947	211,403	28,991,887	194,448	26,555,658
Mineral waters ... gallons sold	(18)	(18)	(18)	(18)	(18)	(18)
Natural gas ... M cubic feet	3,414,689,000	760,950,000	3,711,039,000	797,255,000	3,875,172,000	821,099,000
Natural gasoline and allied products:						
Natural gasoline and cycle products ... gallons	2,773,218,000	122,500,000	3,031,308,000	148,200,000	3,251,172,000	152,500,000
Liquefied petroleum gases ... do	910,854,000	24,410,000	1,170,624,000	34,300,000	1,422,335,000	43,500,000
Oilstones, etc ... short tons	(17)	(17)	(17)	(17)	(17)	(17)
Olivine ... do	5,415	48,633	3,270	35,207	(17)	(17)
Peat ... do	60,002	491,460	57,987	524,521	78,272	600,287
Petroleum ... barrels (42 gallons)	1,505,613,000	1,809,020,000	1,677,904,000	2,032,960,000	1,711,103,000	2,093,300,000
Phosphate rock ... long tons	5,126,232	18,962,021	5,376,643	20,856,429	5,806,723	23,951,077
Potassium salts ... short tons	[21] 732,151	26,183,073	[21] 817,892	29,487,413	[21] 870,370	30,313,919
Pumice ... do	85,150	611,495	88,757	704,110	157,011	1,051,037
Pyrites ... long tons	802,384	2,844,000	788,530	2,598,000	722,596	2,700,000
Salt (sodium chloride) ... short tons	15,214,152	43,878,266	15,717,171	45,989,264	15,394,141	46,069,064
Sand and gravel:						
Glass sand ... do	3,971,931	7,376,566	4,443,031	8,227,502	4,681,920	8,374,218
Sand (molding, building, etc.) and gravel ... do	230,092,000	145,416,000	190,340,000	116,936,000	190,842,000	120,463,000
Silica (quartz) ... do	99,445	346,558	82,379	286,478	57,764	236,803
Slate ... do	468,860	4,870,237	477,840	5,004,195	551,890	5,658,913
Sodium salts (carbonates and sulfates) (natural) ... do	331,901	4,097,635	353,749	4,447,225	372,241	4,559,277
Stone [22] ... do	171,343,250	184,320,034	155,579,580	175,642,157	153,405,210	179,307,902
Sulfur ... long tons	2,953,845	47,300,000	3,519,083	56,300,000	3,833,294	61,300,000
Sulfuric acid (60° Baumé) (byproduct) [23] ... short tons	1,228,098	10,852,563	1,160,023	10,415,587	1,084,891	10,136,598
Talc, pyrophyllite, and soapstone [22] ... do	412,868	5,121,414	398,863	5,017,462	401,080	4,956,901
Tripoli ... do	14,912	244,365	18,425	301,863	18,247	306,829

See footnotes at end of table.

Mineral products of the United States, 1943–45 [1]—Continued

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
NONMETALLIC—continued						
Vermiculite ... short tons	46,645	$471,595	54,116	$541,744	64,808	$648,077
Other nonmetallic [24]		4,770,156		4,511,391		4,224,387
Total value of nonmetallic products (approximate)		5,583,800,000		6,079,000,000		6,168,000,000
SUMMARY						
Total value:						
Metallic		2,488,000,000		2,340,000,000		1,975,000,000
Nonmetallic:						
Fuels		4,608,300,000		5,178,000,000		5,212,000,000
Other		975,500,000		901,000,000		956,000,000
Grand total approximate value of mineral products		8,071,800,000		8,419,000,000		8,143,000,000

[1] In this general statement certain of the figures represent shipments rather than quantity mined, and some of the figures for 1945 are subject to revision. For details see following chapters of this volume.
[2] Figures represent antimonial lead produced at primary refineries from both domestic and foreign primary and secondary sources; no figures for value of antimonial lead available. Estimate of value of primary antimony and lead contents of antimonial lead from domestic sources included in total value of metallic products.
[3] Largely from foreign ore; value not included in total value.
[4] 1943: As shipped; 1944–45: Dried-bauxite equivalent.
[5] Product from domestic ores only.
[6] Value does not include premiums paid to miners by the Government. Total over-ceiling payments for copper, lead, and zinc amounted to approximately $73,000,000 in 1943, $83,000,000 in 1944, and $79,000,000 in 1945.
[7] According to Bureau of the Mint. Valued at $35 per ounce.
[8] Value not included in total value.
[9] Figures not available.
[10] Figures showing values not available.
[11] Value included in total value of metallic products; Bureau of Mines not at liberty to publish figures.
[12] According to Bureau of the Mint.
[13] Includes value of following products. Figures are shown wherever Bureau of Mines is at liberty to publish them.
1943 and 1944: Bismuth, cobalt, germanium, indium, thallium, and zircon.
1945: Bismuth, cobalt, germanium, indium (57,434 troy ounces), thallium, and zircon.
[14] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[15] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value.
[16] Includes brown coal and lignite, and anthracite mined elsewhere than in Pennsylvania.
[17] Value included in total value of nonmetallic products; Bureau of Mines not at liberty to publish figures.
[18] No canvass. Estimate of value included in total value of nonmetallic products.
[19] Figures cover fiscal year ended June 30 of year stated.
[20] Sublimed blue lead, sublimed white lead, leaded zinc oxide, and zinc oxide.
[21] Equivalent as K_2O.
[22] Figures for soapstone used as dimension stone included in figures for stone.
[23] From copper, lead, and zinc smelters and zinc roasters.
[24] Includes value of following products. Figures are shown wherever Bureau of Mines is at liberty to publish them.
1943: Andalusite, crude aplite, natural sulfonated bitumen, calcite (Iceland spar), corundum, dumortierite, flint lining for tube mills (2,585 short tons, $46,071), pebbles for grinding (9,924 short tons, $157,778), quartz crystal (5,968 pounds, $25,598), silica sand and sandstone (ground) (541,350 short tons, $3,937,452), strontium minerals (7,566 short tons, $114,526), sulfur ore (2,572 long tons, $26,215), industrial topaz, and wollastonite.
1944: Andalusite, crude aplite, natural sulfonated bitumen, calcite (Iceland spar) (5,748 pounds, $57,480), corundum, dumortierite, flint lining for tube mills (2,063 short tons, $38,833), pebbles for grinding (8,012 short tons, $172,418), quartz crystal (3,934 pounds, $23,769), silica sand and sandstone (ground) (558,606 short tons, $3,989,981), strontium minerals (3,005 short tons, $48,165), sulfur ore (1,639 long tons, $8,950), industrial topaz, and wollastonite.
1945: Andalusite, crude aplite, dumortierite, flint lining for tube mills, pebbles for grinding (8,615 short tons, $201,806), silica sand and sandstone (ground) (533,656 short tons, $3,709,597), strontium minerals (2,784 short tons, $27,840), sulfur ore (1,426 long tons, $12,170), industrial topaz, and wollastonite.

Value of mineral products of the United States, 1880–1945 [1]

Year	Metallic	Nonmetallic			Grand total
		Fuels [2]	Other	Total	
1880 [1]	$190, 881, 000	$120, 241, 000	$56, 341, 000	$176, 582, 000	$367, 463, 000
1881	192, 663, 000	149, 798, 000	60, 659, 000	210, 457, 000	403, 120, 000
1882	219, 070, 000	170, 479, 000	63, 557, 000	234, 036, 000	453, 106, 000
1883	201, 131, 000	185, 760, 000	61, 170, 000	246, 930, 000	448, 061, 000
1884	182, 784, 000	165, 825. 000	58, 431, 000	224, 256, 000	407, 040, 000
1885	174, 718, 000	183, 075, 000	61, 758, 000	244, 833, 000	419, 551, 000
1886	204, 795, 000	184, 608, 000	66, 782, 000	251, 390, 000	456, 185, 000
1887	241, 183, 000	217, 251, 000	77, 199, 000	294, 450, 000	535, 633, 000
1888	242, 460, 000	231, 459, 000	79, 880, 000	311, 339, 000	553, 799, 000
1889	250, 823, 000	208, 297, 000	83, 206, 000	291. 503, 000	542, 326, 000
1890	303, 937, 000	230, 962, 000	80, 530, 000	311, 492. 000	615, 429. 000
1891	280, 985, 000	237, 160, 000	82, 704, 000	319, 864, 000	600, 849, 000
1892	284, 215, 000	248, 344, 000	89, 673, 000	338, 017, 000	622, 232, 000
1893	223, 654, 000	251, 735, 000	70, 104, 000	321, 839, 000	545, 493, 000
1894	187. 335, 000	235. 618, 000	127, 292, 000	362, 910, 000	550, 245, 000
1895	248, 533, 000	268, 438, 000	125, 720, 000	394. 158, 000	642, 691, 000
1896	252, 575, 000	268, 161, 000	120, 305, 000	388, 466, 000	641, 041, 000
1897	270, 434. 000	253, 598. 000	127, 580, 000	381, 178. 000	651, 612, 000
1898	308, 747, 000	267, 513, 000	150, 782, 000	418, 295, 000	727, 042, 000
1899	484, 021, 000	340, 773, 000	185, 302, 000	526, 075, 000	1, 010, 096, 000
1900	514, 232, 000	406, 376, 000	188, 328, 000	594, 704, 000	1, 108, 936. 000
1901	493, 814, 000	442, 409. 000	218, 855, 000	661, 264, 000	1, 155, 078, 000
1902	605, 017, 000	469, 079, 000	253, 855, 000	722, 934, 000	1, 327, 951, 000
1903	589, 253, 000	634, 226, 000	271, 902, 000	906, 128. 000	1, 495, 381, 000
1904	501, 314, 000	584, 043, 000	273, 824, 000	857, 867, 000	1, 359, 181, 000
1905	702. 785, 000	602, 258, 000	318, 722, 000	920, 980, 000	1, 623, 765, 000
1906	886, 280, 000	652, 398, 000	362, 202, 000	1, 014, 600, 000	1, 900. 880, 000
1907	904, 151, 000	789, 128, 000	376, 291, 000	1, 165, 419, 000	2, 069, 570, 000
1908	550, 890, 000	716, 034, 000	324, 849, 000	1, 040, 883, 000	1, 591, 773, 000
1909	755, 092, 000	746, 204, 000	385, 811. 000	1, 132, 015, 000	1, 887, 107, 000
1910	750, 027, 000	828, 213, 000	409, 604, 000	1, 237, 817, 000	1, 987, 844, 000
1911	681, 023, 000	835, 763, 000	407, 295, 000	1, 243, 058, 000	1, 924, 081, 000
1912	862, 191, 000	945, 541, 000	430, 062, 000	1, 375, 603, 000	2, 237, 794, 000
1913	879, 058, 000	1, 087, 843, 000	466, 644, 000	1, 554, 487, 000	2, 433, 545, 000
1914	687, 101, 000	992, 837, 000	431, 234, 000	1, 424, 071, 000	2, 111, 172, 000
1915	993, 353, 000	972, 617, 000	428, 674, 000	1, 401, 291, 000	2, 394, 644, 000
1916	1, 622, 129, 000	1, 332, 584, 000	553, 726, 000	1, 886, 310, 000	3, 508, 439, 000
1917	2, 088, 914, 000	2, 237, 837, 000	665, 745, 000	2, 903, 582, 000	4, 992, 496, 000
1918	2, 156, 588, 000	2, 736, 151, 000	647, 969, 000	3, 384, 120, 000	5, 540, 708, 000
1919	1, 361, 099, 000	2, 510, 894, 000	751, 777, 000	3, 262, 671, 000	4, 623, 770, 000
1920	1, 763, 675, 000	4, 192, 910, 000	1, 024, 755, 000	5, 217, 665, 000	6, 981, 340, 000
1921	654, 700, 000	2, 703, 470, 000	780, 330, 000	3, 483, 800, 000	4, 138, 500, 000
1922	988, 100, 000	2, 737, 880, 000	921, 310, 000	3, 659, 190, 000	4, 647, 290, 000
1923	1, 511, 930, 000	3, 317, 100, 000	1, 157, 470, 000	4, 474, 570, 000	5, 986, 500, 000
1924	1, 233, 370, 000	2, 898, 630, 000	1, 173, 800, 000	4, 072, 430, 000	5, 305, 800, 000
1925	1, 382, 155, 000	3, 058, 680, 000	1, 236, 795, 000	4, 295, 475. 000	5, 677, 630, 000
1926	1, 405, 345, 000	3, 541, 916, 000	1, 266, 339, 000	4, 808, 255, 000	6, 213, 600, 000
1927	1, 220, 633, 000	3, 060, 047, 000	1, 249, 320, 000	4, 309, 367, 000	5, 530, 000, 000
1928	1, 288, 290, 000	2, 884, 962, 000	1, 211, 948, 000	4, 096, 910, 000	5, 385. 200, 000
1929	1, 480, 390, 000	3, 190, 527, 000	1, 216, 683, 000	4, 407, 210, 000	5, 887, 600, 000
1930	985, 790, 000	2, 764. 500, 000	1, 014, 510, 000	3, 779, 010, 000	4, 764, 800, 000
1931	569, 790, 000	1, 892, 400, 000	704, 410, 000	2, 596, 810, 000	3, 166, 600, 000
1932	285, 875, 000	1, 743, 400, 000	432, 425, 000	2, 175, 825, 000	2, 461, 700, 000
1933	417. 065, 000	1, 683, 400, 000	454, 635, 000	2, 138, 035, 000	2, 555, 100, 000
1934	548, 934, 000	2, 233, 300, 000	543, 166, 000	2, 776, 466, 000	3, 325, 400, 000
1935	733, 130, 000	2, 330, 000, 000	586, 870, 000	2, 916, 870, 000	3, 650, 000, 000
1936	1, 081, 600, 000	2, 759, 200, 000	716, 000, 000	3, 475, 200, 000	4, 556, 800, 000
1937	1, 468, 200, 000	3, 200, 500, 000	744, 700, 000	3, 945, 200, 000	5, 413, 400, 000
1938	892, 600, 000	2, 820, 300, 000	650, 300, 000	3, 470, 600, 000	4, 363, 200, 000
1939	1, 291, 700, 000	2, 834, 300, 000	788, 200, 000	3, 622, 500, 000	4, 914, 200, 000
1940	1, 678, 600, 000	3, 116, 500, 000	818, 800, 000	3, 935, 300, 000	5, 613, 900, 000
1941	2, 132, 000, 000	3, 708, 100, 000	1, 037, 900, 000	4, 746, 000, 000	6, 878, 000, 000
1942	2, 363. 900, 000	4, 103, 400, 000	1, 109. 000, 000	5, 212, 400, 000	7, 576, 300, 000
1943	2, 488, 000, 000	4. 608, 300, 000	975, 500, 000	5, 583, 800, 000	8, 071, 800, 000
1944	2, 340, 000, 000	5, 178, 000, 000	901, 000, 000	6, 079, 000, 000	8, 419, 000, 000
1945 [3]	1, 975, 000, 000	5, 212. 000, 000	956, 000, 000	6, 168, 000, 000	8, 143, 000, 000
Grand total	57, 710, 027, 000	106, 715, 252, 000	33, 668, 510, 000	140, 383, 762, 000	198, 093, 789, 000

[1] Figures for earlier years not available.
[2] Coal, natural gas, natural gasoline and allied products, petroleum.
[3] Subject to revision.

The sum of the following State totals does not reach the total for the United States given in the preceding table partly because figures for certain of the products included in the United States total are not available by States of origin. This fact is brought out in the opening text of this chapter and in the second table following.

In addition, there are many factors (the more important discussed in the opening text) that account for the disagreement between the sum of the State totals and the grand total for the United States, by products. Chief among these are: (1) The use of iron-ore values in State totals and pig-iron values in United States total; (2) the use of mine figures for gold, silver, copper, lead, and zinc in the State totals and mint and smelter figures (supplemented by the value of byproduct sulfuric acid from copper, lead, and zinc smelting and zinc roasting and the value of zinc and lead pigments made in large part direct from ores) in the United States total; and (3) the inclusion of estimates in the United States total for a few products for which no canvass has been conducted for many years and for which no estimate by States is made.

Many other less important differences are involved, but both State and United States totals are as complete and definite as seems possible with the data available. The practice is consistent from year to year, and it is believed that the reader can determine readily just what minerals are covered by the total concerned.

In every table each mineral produced is listed, and all figures are shown except those that the Bureau of Mines is not at liberty to publish.

Value of mineral products of the United States, 1941–45, and total, 1911–45, by States [1]

State	1941	1942	1943	1944	1945	1911–45 [1]		
						Total value	Rank	Percent of total for United States
Alabama	$82, 730, 210	$100, 222, 752	$102, 584, 000	$109, 149, 000	$111, 158, 000	$2, 103, 320, 000	20	1. 44
Alaska	26, 809, 380	20, 094, 260	9, 055, 000	6, 903, 000	10, 210, 000	726, 764, 000	31	. 50
Arizona	100, 472, 791	117, 990, 899	124, 584, 000	115, 592, 000	98, 553, 000	3, 227, 771, 000	13	2. 21
Arkansas	47, 081, 326	60, 337, 118	81, 249, 000	68, 681, 000	62, 772, 000	1, 149, 493, 000	26	. 79
California	506, 795, 395	541, 391, 606	565, 441, 000	607, 302, 000	627, 306, 000	12, 569, 315, 000	3	8. 61
Colorado	73, 960, 602	95, 278, 822	88, 534, 000	80, 202, 000	76, 862, 000	2, 130, 271, 000	19	1. 46
Connecticut	5, 284, 955	5, 054, 812	4, 835, 000	4, 496, 000	3, 492, 000	160, 824, 000	42	. 11
Delaware	492, 631	402, 273	367, 000	182, 000	131, 000	13, 459, 000	50	. 01
District of Columbia	700, 000	600, 000	100, 000	111, 000	229, 000	19, 955, 000	49	. 01
Florida	19, 268, 779	20, 303, 948	25, 070, 000	21, 852, 000	24, 995, 000	476, 517, 000	34	. 33
Georgia	21, 049, 261	22, 008, 807	20, 927, 000	18, 972, 000	19, 939, 000	430, 281, 000	35	. 29
Idaho	45, 673, 740	54, 289, 536	57, 475, 000	51, 321, 000	44, 348, 000	1, 085, 847, 000	28	. 74
Illinois	320, 509, 559	327, 665, 438	322, 050, 000	330, 971, 000	332, 489, 000	6, 961, 966, 000	6	4. 77
Indiana	80, 572, 397	89, 571, 417	83, 513, 000	90, 465, 000	90, 061, 000	2, 642, 364, 000	15	1. 81
Iowa	28, 872, 177	28, 278, 387	24, 187, 000	22, 462, 000	24, 820, 000	1, 053, 700, 000	29	. 72
Kansas	171, 991, 685	201, 454, 022	220, 413, 000	217, 876, 000	210, 187, 000	3, 978, 340, 000	9	2. 73
Kentucky	169, 009, 195	204, 294, 168	236, 578, 000	276, 701, 000	268, 858, 000	4, 134, 463, 000	8	2. 83
Louisiana	228, 440, 044	246, 438, 691	269, 412, 000	288, 374, 000	298, 842, 000	3, 575, 025, 000	12	2. 45
Maine	4, 692, 448	3, 614, 054	2, 720, 000	2, 146, 000	2, 483, 000	150, 824, 000	43	. 10
Maryland	17, 291, 523	18, 383, 872	17, 508, 000	15, 264, 000	15, 030, 000	529, 272, 000	33	. 36
Massachusetts	9, 293, 169	8, 467, 398	5, 441, 000	5, 260, 000	5, 447, 000	330, 518, 000	39	. 23
Michigan	142, 433, 673	161, 433, 922	157, 016, 000	152, 135, 000	140, 677, 000	3, 885, 632, 000	10	2. 66
Minnesota	178, 790, 274	191, 649, 723	177, 687, 000	170, 465, 000	167, 140, 000	3, 825, 484, 000	11	2. 62
Mississippi	17, 750, 726	29, 992, 924	21, 178, 000	18, 940, 000	21, 816, 000	182, 692, 000	41	. 13
Missouri	61, 545, 052	76, 122, 304	72, 212, 000	72, 960, 000	74, 171, 000	2, 237, 452, 000	18	1. 53
Montana	86, 583, 460	96, 681, 604	91, 743, 000	89, 052, 000	75, 816, 000	2, 520, 288, 000	17	1. 73
Nebraska	6, 499, 070	8, 428, 200	6, 800, 000	5, 060, 000	4, 953, 000	141, 772, 000	44	. 10
Nevada	46, 341, 010	46, 313, 373	56, 525, 000	51, 800, 000	31, 517, 000	1, 124, 356, 000	27	. 77
New Hampshire	1, 382, 506	1, 211, 184	1, 350, 000	1, 166, 000	801, 000	72, 545, 000	47	. 05
New Jersey	39, 074, 518	38, 921, 351	37, 583, 000	33, 794, 000	31, 253, 000	1, 624, 455, 000	21	1. 11
New Mexico	97, 849, 086	106, 811, 195	123, 805, 000	124, 827, 000	116, 508, 000	1, 552, 551, 000	23	1. 06
New York	91, 582, 704	103, 298, 336	88, 416, 000	87, 632, 000	90, 286, 000	2, 560, 160, 000	16	1. 75
North Carolina	18, 915, 461	17, 372, 690	22, 172, 000	22, 199, 000	14, 457, 000	334, 042, 000	37	. 23
North Dakota	3, 327, 627	4, 028, 008	4, 422, 000	4, 393, 000	4, 551, 000	93, 319, 000	46	. 06
Ohio	164, 826, 884	175, 548, 629	189, 422, 000	192, 052, 000	196, 633, 000	6, 142, 310, 000	7	4. 21
Oklahoma	263, 763, 923	271, 298, 469	254, 642, 000	260, 832, 000	282, 859, 000	10, 088, 465, 000	5	6. 91
Oregon	12, 830, 176	14, 065, 572	12, 267, 000	9, 657, 000	9, 398, 000	224, 612, 000	40	. 15

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. Comparable totals for years before 1911 not available.

Value of mineral products of the United States, 1941–45, and total, 1911–45, by States—Continued

State	1941	1942	1943	1944	1945	1911–45		
						Total value	Rank	Percent of total for United States
Pennsylvania	$737, 143, 530	$841, 847, 147	$889, 077, 000	$985, 464, 000	$930, 113, 000	$26, 008, 966, 000	1	17. 82
Rhode Island	1, 133, 400	836, 040	808, 000	612, 000	508, 000	30, 889, 000	48	. 02
South Carolina	7, 245, 613	5, 890, 982	4, 759, 000	4, 192, 000	5, 043, 000	108, 379, 000	45	. 07
South Dakota	24, 501, 696	24, 139, 283	8, 608, 000	5, 472, 000	7, 165, 000	426, 173, 000	36	. 29
Tennessee	56, 301, 592	67, 223, 639	64, 485, 000	63, 998, 000	60, 199, 000	1, 269, 177, 000	25	. 87
Texas	868, 082, 690	909, 203, 286	1, 103, 390, 000	1, 321, 541, 000	1, 360, 694, 000	15, 672, 310, 000	2	10. 74
Utah	122, 386, 873	146, 968, 512	164, 150, 000	149, 558, 000	129, 386, 000	2, 839, 150, 000	14	1. 94
Vermont	8, 131, 670	7, 266, 089	6, 404, 000	7, 672, 000	8, 233, 000	332, 170, 000	38	. 23
Virginia	71, 340, 934	79, 770, 810	85, 825, 000	87, 001, 000	84, 081, 000	1, 414, 436, 000	24	. 97
Washington	28, 506, 882	35, 659, 543	37, 593, 000	36, 483, 000	31, 588, 000	747, 917, 000	30	. 51
West Virginia	425, 626, 303	493, 994, 630	564, 230, 000	598, 425, 000	597, 377, 000	10, 928, 302, 000	4	7. 49
Wisconsin	17, 020, 722	17, 998, 036	18, 930, 000	22, 794, 000	22, 213, 000	571, 828, 000	32	. 39
Wyoming	52, 751, 354	64, 070, 497	70, 737, 000	74, 175, 000	81, 105, 000	1, 584, 357, 000	22	1. 09

Mineral products of the United States and principal producing States in 1944

Rank in value	Product	Principal producing States[1]	
		In order of quantity	In order of value
9	Aluminum	Washington, New York, Tennessee, Arkansas	Rank same as for quantity.
97	Andalusite	California	Do.
(2)	Antimonial lead	Not separable by States	Not separable by States.
68	Antimony ore	Idaho, Oregon, Nevada, Alaska	Rank same as for quantity.
85	Aplite (crude)	Virginia	Do.
55	Arsenious oxide	Montana, Utah	Do.
75	Asbestos	Vermont, Arizona, North Carolina, California	Vermont, Arizona, California, Alaska.
	Asphalt:		
49	Native	Texas, Kentucky, Oklahoma, Alabama	Utah, Kentucky, Texas, Oklahoma.
15	Oil	Not separable by States	Not separable by States.
50	Barite (crude)	Arkansas, Missouri, Georgia, Tennessee	Missouri, Arkansas, Georgia, Tennessee.
32	Bauxite	Arkansas, Alabama, Georgia	Rank same as for quantity.
90	Beryllium ore	South Dakota, Colorado, New Mexico, New Hampshire	Do.
59	Bismuth	Not separable by States	Not separable by States.
103	Bitumen (natural sulfonated)	Utah	Rank same as for quantity.
39	Boron minerals	California	Do.
29	Bromine	Texas, North Carolina, Michigan, California	Do.
38	Cadmium	Not separable by States	Not separable by States.
89	Calcite (Iceland spar)	Montana, California	Rank same as for quantity.
58	Calcium-magnesium chloride	Michigan, West Virginia, California, Ohio	Michigan, California, West Virginia, Ohio.
12	Cement	California, Pennsylvania, Texas, Indiana	Rank same as for quantity.
57	Chromite	California, Oregon, Alaska, Montana	Do.
	Clay:		
16	Products (other than pottery and refractories).		Ohio, Pennsylvania, California, Illinois.
27	Raw (sold or shipped by producers)	Pennsylvania, Missouri, Georgia, Ohio	Georgia, Pennsylvania, Missouri, Wyoming.
1	Coal:		
	Bituminous	West Virginia, Pennsylvania, Illinois, Kentucky	West Virginia, Pennsylvania, Kentucky, Illinois.
	Pennsylvania anthracite	Pennsylvania	Rank same as for quantity.
67	Cobalt	Pennsylvania, Missouri	Do.
5	Coke	Pennsylvania, Ohio, Indiana, New York	Pennsylvania, Indiana, Ohio, New York.
8	Copper	Arizona, Utah, Montana, New Mexico	Rank same as for quantity.
106	Corundum	South Carolina	Do.
51	Diatomite	California, Oregon, Nevada, Washington	Do.
104	Dumortierite	Nevada	Do.
87	Emery	New York	Do.
54	Feldspar (crude)	North Carolina, South Dakota, New Hampshire, Virginia	Do.
7	Ferro-alloys	Pennsylvania, New York, Ohio, West Virginia	Pennsylvania, New York, West Virginia, Ohio.
92	Flint lining for tube mills	Minnesota, North Carolina, Wisconsin	Rank same as for quantity.
33	Fluorspar	Illinois, Kentucky, Colorado, New Mexico	Do.
52	Fuller's earth	Texas, Georgia, Florida, Illinois	Georgia, Texas, Florida, Illinois.
78	Garnet (abrasive)	New York, Idaho	Rank same as for quantity.

See footnotes at end of table.

Mineral products of the United States and principal producing States in 1944—Continued

Rank in value	Product	Principal producing States: In order of quantity	Principal producing States: In order of value
(3)	Gems and precious stones	No canvass for 1944	No canvass for 1944.
98	Germanium	Not separable by States	Not separable by States.
22	Gold	Utah, Nevada, California, Arizona	Rank same as for quantity.
77	Graphite:		
	Amorphous	Rhode Island	Do.
	Crystalline	Texas, Alabama, Montana	Do.
76	Grindstones and pulpstones	Ohio, West Virginia	Do.
40	Gypsum (crude)	New York, Michigan, California, Iowa	New York, Michigan, California, Nevada.
63	Helium	Texas, Kansas, New Mexico	Rank same as for quantity.
74	Indium	Not separable by States	Not separable by States.
65	Iodine (natural)	California	Rank same as for quantity.
	Iron:		
6	Ore	Minnesota, Michigan, Alabama, New York	Do.
3	Pig	Pennsylvania, Ohio, Indiana, Illinois	Do.
82	Kyanite	Virginia	Do.
19	Lead	Missouri, Idaho, Utah, Colorado	Do.
20	Lime	Ohio, Pennsylvania, Missouri, West Virginia	Do.
69	Lithium minerals	North Carolina, South Dakota, California, Colorado	Do.
45	Magnesite (crude)	Washington, Nevada, California, Texas	Do.
17	Magnesium	Texas, Nevada, Ohio, Michigan	Do.
30	Magnesium compounds (natural)	Texas, Michigan, California, Nevada	Texas, Michigan, California, New Jersey.
35	Manganese ore	Montana, Nevada, California, Virginia	Rank same as for quantity.
48	Manganiferous ore	Minnesota, New Mexico, Michigan, Utah	Minnesota, New Mexico, Utah, Arkansas.
64	Manganiferous zinc residuum	New Jersey	Rank same as for quantity.
	Marl:		
84	Calcareous	Virginia, Michigan, Wisconsin, Illinois	Virginia, Michigan, West Virginia, Nevada.
73	Greensand	New Jersey	Rank same as for quantity.
43	Mercury	California, Oregon, Nevada, Idaho	Do.
46	Mica	North Carolina, Colorado, Georgia, South Dakota	North Carolina, New Hampshire, South Dakota, Idaho.
	Scrap	do	North Carolina, Georgia, New Hampshire, South Dakota.
	Sheet	North Carolina, New Hampshire, South Dakota, Connecticut.	North Carolina, New Hampshire, South Dakota, Idaho.
99	Millstones		North Carolina, Virginia, New York.
	Mineral pigments:		
36	Natural pigments and manufactured iron oxide pigments.	Pennsylvania, Illinois, New Jersey, Virginia	Pennsylvania, New Jersey, Illinois, Virginia.
24	Lead and zinc pigments	Pennsylvania, Illinois, Kansas, Ohio	Rank same as for quantity.
(3)	Mineral waters	No canvass for 1944	No canvass for 1944.
25	Molybdenum	Colorado, Utah, New Mexico, California	Colorado, Utah, New Mexico, Arizona.
4	Natural gas	Texas, Louisiana, California, Oklahoma	Texas, California, Louisiana, West Virginia.
10	Natural gasoline and allied products:		
	Natural gasoline and cycle products	Texas, California, Louisiana, Oklahoma	Rank same as for quantity.
	Liquefied petroleum gases	Texas, California, Illinois, Oklahoma	Do.
71	Nickel	Not separable by States	Not separable by States.
81	Oilstones, etc	Arkansas, Ohio, New Hampshire, Indiana	Rank same as for quantity.

93	Olivine	North Carolina	Do.
(4)	Ores (crude), etc.:		
	Copper	Arizona, Utah, New Mexico, Nevada	Value not available.
	Dry and siliceous (gold and silver)	Colorado, Nevada, Alaska, Idaho	Do.
	Lead	Missouri, Idaho, California, Arizona	Do.
	Lead-copper	Missouri, Idaho	Do.
	Zinc	Oklahoma, Kansas, Tennessee, Missouri	Do.
	Zinc-copper	Washington, Arizona, California	Do.
	Zinc-lead	Oklahoma, Kansas, Idaho, Missouri	Do.
	Zinc-lead-copper	Arizona, Utah	Do.
72	Peat	New Jersey, Illinois, Michigan, Pennsylvania	Michigan, New Jersey, Maine, Illinois.
83	Pebbles for grinding	Texas, Minnesota, North Carolina, Wisconsin	Rank same as for quantity.
2	Petroleum	Texas, California, Louisiana, Oklahoma	Do.
28	Phosphate rock	Florida, Tennessee, Montana, Idaho	Do.
60	Platinum metals	Alaska, Montana	Do.
23	Potassium salts	New Mexico, California, Utah, Maryland	Do.
66	Pumice	Kansas, California, Nebraska, New Mexico	California, New Mexico, Kansas, Nebraska.
53	Pyrites	Tennessee, California, Virginia, Montana	Tennessee, California, Virginia, New York.
96	Quartz crystal	Not separable by States	Not separable by States.
21	Salt	Michigan, New York, Ohio, Louisiana	Michigan, New York, Kansas, Louisiana.
13	Sand and gravel	California, Illinois, Michigan, Ohio	California, Illinois, Ohio, Pennsylvania.
61	Selenium	Not separable by States	Not separable by States.
80	Silica (quartz)	Washington, California, Wisconsin, North Carolina	California, Washington, North Carolina, Wisconsin.
47	Silica sand and sandstone (ground)	Illinois, New Jersey, Ohio, Pennsylvania	Illinois, Ohio, New Jersey, Pennsylvania.
26	Silver	Idaho, Utah, Montana, Arizona	Rank same as for quantity.
42	Slate		Pennsylvania, Vermont, New York, Maryland.
44	Sodium salts (carbonates and sulfates) (natural)	California, Texas, Wyoming	Rank same as for quantity.
11	Stone	Pennsylvania, Michigan, Ohio, Illinois	Pennsylvania, Ohio, Illinois, California.
91	Strontium minerals	Texas, California	Rank same as for quantity.
18	Sulfur	Texas, Louisiana	Do.
34	Sulfuric acid from copper, lead, and zinc smelters and zinc roasters.	Pennsylvania, Illinois, Tennessee, Indiana	Do.
100	Sulfur ore	Texas, Colorado	Do.
41	Talc, pyrophyllite, and ground soapstone [5]	New York, North Carolina, California, Vermont	New York, California, Vermont, North Carolina.
95	Tantalum and columbium ores	New Mexico, South Dakota, North Carolina, Virginia	Rank same as for quantity.
88	Tellurium	Not separable by States	Not separable by States.
86	Thallium	do	Do.
102	Tin	South Dakota, California, New Mexico, North Carolina	Rank same as for quantity.
	Titanium concentrates:		
37	Ilmenite	New York, Virginia, Florida, North Carolina	Do.
62	Rutile	Florida, Virginia, Arkansas	Do.
94	Topaz (industrial)	South Carolina	Do.
79	Tripoli	Illinois, Missouri, Pennsylvania, Arkansas	Do.
31	Tungsten ore	Idaho, California, Nevada, Colorado	Do.
56	Vanadium	Colorado, Utah, Idaho, Arizona	Do.
70	Vermiculite	Montana, Colorado, South Carolina, Wyoming	Do.
105	Wollastonite	New York	Do.
14	Zinc	Oklahoma, Idaho, New Jersey, Kansas	Oklahoma, Idaho, Kansas, New Jersey.
101	Zircon	Florida	Rank same as for quantity.

[1] Rank of States in metal production (except aluminum, ferro-alloys, and pig iron) arranged according to mine reports, not smelter output. Compilation of rank for 1945 not yet available.
[2] Separate figures for antimonial lead from primary sources not available.
[3] No canvass for 1944. [4] Value not available. [5] Exclusive of soapstone used as dimension stone (all from Virginia), which is included in figures for stone.

States and their principal mineral products in 1944 [1]

State	Rank	Percent of total value for United States	Principal mineral products in order of value
Alabama	16	1.56	Coal, iron ore, cement, stone.
Alaska	39	.10	Coal, gold, platinum metals, stone.
Arizona	15	1.65	Copper, zinc, gold, silver.
Arkansas	24	.98	Petroleum, bauxite, coal, natural gas.
California	3	8.69	Petroleum, natural gas, natural gasoline, cement.
Colorado	21	1.15	Coal, molybdenum, zinc, gold.
Connecticut	43	.06	Magnesium, stone, sand and gravel, clay products.
Delaware	49	(2)	Clay products, sand and gravel, stone.
District of Columbia	50	(2)	Clay products.
Florida	33	.31	Phosphate rock, stone, cement, sand and gravel.
Georgia	34	.27	Raw clay, stone, clay products, cement.
Idaho	27	.73	Zinc, lead, silver, tungsten ore.
Illinois	5	4.74	Coal, petroleum, stone, sand and gravel.
Indiana	17	1.30	Coal, cement, petroleum, stone.
Iowa	31	.32	Coal, cement, stone, clay products.
Kansas	9	3.12	Petroleum, natural gas, zinc, coal.
Kentucky	7	3.96	Coal, natural gas, petroleum, stone.
Louisiana	6	4.13	Petroleum, natural gas, natural gasoline, sulfur.
Maine	46	.03	Sand and gravel, cement, stone, lime.
Maryland	36	.22	Coal, sand and gravel, cement, stone.
Massachusetts	41	.08	Stone, sand and gravel, lime, clay products.
Michigan	12	2.18	Iron ore, petroleum, salt, natural gas.
Minnesota	11	2.44	Iron ore, manganiferous ore, stone, sand and gravel.
Mississippi	35	.27	Petroleum, sand and gravel, clay products, raw clay.
Missouri	23	1.04	Lead, coal, zinc, lime.
Montana	18	1.27	Copper, petroleum, coal, natural gas.
Nebraska	42	.07	Sand and gravel, cement, stone, petroleum.
Nevada	26	.74	Copper, magnesium, zinc, gold.
New Hampshire	47	.02	Mica, feldspar, sand and gravel, clay products.
New Jersey	29	.48	Zinc, sand and gravel, clay products, iron ore.
New Mexico	14	1.79	Petroleum, potassium salts, copper, natural gas.
New York	19	1.25	Petroleum, iron ore, salt, zinc.
North Carolina	32	.32	Bromine, stone, clay products, mica.
North Dakota	44	.06	Coal, sand and gravel, natural gas, clay products.
Ohio	10	2.75	Coal, natural gas, stone, clay products.
Oklahoma	8	3.73	Petroleum, natural gas, zinc, natural gasoline.
Oregon	37	.14	Sand and gravel, stone, cement, clay products.
Pennsylvania	2	14.10	Coal, petroleum, natural gas, stone.
Rhode Island	48	.01	Sand and gravel, stone, graphite.
South Carolina	45	.06	Stone, raw clay, clay products, sand and gravel.
South Dakota	40	.08	Stone, raw clay, sand and gravel, mica.
Tennessee	25	.92	Coal, zinc, stone, cement.
Texas	1	18.91	Petroleum, natural gas, natural gasoline, sulfur.
Utah	13	2.14	Copper, coal, gold, zinc.
Vermont	38	.11	Stone, slate, talc, copper.
Virginia	20	1.25	Coal, stone, zinc, sand and gravel.
Washington	28	.52	Coal, cement, sand and gravel, magnesium.
West Virginia	4	8.56	Coal, natural gas, petroleum, natural gasoline.
Wisconsin	30	.33	Stone, iron ore, sand and gravel, zinc.
Wyoming	22	1.06	Petroleum, coal, natural gas, natural gasoline.

[1] In this table iron ore, not pig iron, is taken as the basis of iron valuation, and for other metals mine production (recoverable content of metals) is the basis. Compilation of rank for 1945 not yet available.
[2] Less than 0.01 percent.

Prices of gold, silver, copper, lead, and zinc, 1932–45 [1]

Year	Gold [2]	Silver [3]	Copper [4]	Lead [4]	Zinc [4]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1932	[5] $20.67+	$0.282	$0.063	$0.030	$0.030
1933	25.56	.350	.064	.037	.042
1934	34.95	[6] .646+	.080	.037	.043
1935	35.00	.71875	.083	.040	.044
1936	35.00	.7745	.092	.046	.050
1937	35.00	.7735	.121	.059	.065
1938	35.00	[6] .646+	.098	.046	.048
1939	35.00	[7] .678+	.104	.047	.052
1940	35.00	[8] .711+	.113	.050	.063
1941	35.00	[8] .711+	.118	.057	.075
1942	35.00	[8] .711+	.121	.067	.093
1943	35.00	[8] .711+	.130	.075	.108
1944	35.00	[8] .711+	.135	.080	.114
1945	35.00	[8] .711+	.135	.086	.115

[1] Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ per fine ounce. For table of prices for silver, copper, lead, and zinc from 1850 to 1931, by years, see Mineral Resources, 1931, pt. 1, p. A115.
[2] 1932: Legal coinage value; 1933–34: Yearly average weighted Government price; 1935–44: Price under authority of Gold Reserve Act of Jan. 31, 1934.
[3] 1932–33: Average New York price for bar silver; 1934 and 1938–45: Treasury buying price for newly mined silver; 1935–37: Yearly average weighted Treasury buying price for newly mined silver.
[4] Yearly average weighted price of all grades of primary metal sold by producers. Beginning 1942, price includes premiums paid to miners by the Government.
[5] $20.671835. [6] $0.64646464. [7] $0.67878787. [8] $0.71111111.

STATE TABLES

Mineral products of the United States, 1943–45, by States

ALABAMA

Product		1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Aluminum	short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Asphalt (native)	do	(1)	(1)	(1)	(1)	(1)	(1)
Bauxite	long tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	[3] 7,368,567	[3] $10,943,926	[3] 4,553,664	[3] $6,777,741	[3] 5,682,692	[3] $8,359,286
Clay:							
Products (other than pottery and refractories)			[4] 1,500,000		[4] 1,970,000		[4] 2,515,068
Raw	short tons	[5] 185,442	[5] 259,899	[5] 155,717	[5] 230,186	[5] 735,504	[5] 715,274
Coal	do	17,160,320	59,145,788	18,752,165	74,389,893	18,737,000	77,196,000
Coke	do	5,351,129	[2] 28,006,359	5,727,612	[2] 32,057,495	5,400,925	[2] 33,448,229
Ferro-alloys	do	92,555	[2] 9,340,169	128,729	[2] 11,609,967	145,377	[2] 14,636,471
Gold	troy ounces					5	175
Graphite, crystalline	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Iron:							
Ore	long tons	8,060,473	21,047,231	6,808,111	17,684,154	6,038,631	14,547,223
Pig	short tons	3,811,987	[2] 66,151,938	3,936,471	[2] 68,239,438	3,588,863	[2] 65,991,229
Lime	do	331,182	1,959,266	333,414	2,004,391	315,559	2,076,768
Manganese ore	do			49	(1)	32	(1)
Mica:							
Scrap	do	77	1,108	63	1,036		
Sheet	pounds	12,750	22,507	1,387	7,173	420	1,629
Mineral waters	gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Ore (dry and siliceous) (gold and silver)	short tons					400	(7)
Petroleum	barrels			43,000	(1)	181,000	(1)
Quartz crystal	pounds	(1)	(1)	(8)	(8)		
Sand and gravel	short tons	3,704,777	2,029,186	2,019,272	1,172,969	2,541,769	1,580,687
Silver	troy ounces					1	1
Stone	short tons	2,568,520	3,178,908	2,542,210	3,385,801	2,238,740	3,326,753
Miscellaneous [9]			17,427,758		16,573,667		12,163,970
Total value, eliminating duplications			102,584,000		109,149,000		111,158,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of puzzolan, value for which is included under "Miscellaneous."
[4] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[5] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Figures not available.
[9] Includes minerals indicated by "1" and "3" above.

Mineral products of the United States, 1943–45, by States—Continued

ALASKA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Antimony ore (concentrates)....short tons..	405	$33, 324	73	$6, 465		
Arsenic....do....	(1)	(1)	(1)	(1)	(1)	(1)
Asbestos....do....			(2)	(2)		
Chromite....do....	5, 569	186, 251	1, 845	64, 456		
Coal....do....	289, 232	1, 842, 708	348, 375	2, 239, 684	300, 000	$1, 905, 000
Copper....pounds..	54, 000	7, 020	4, 000	540	10, 000	1, 350
Gems and precious stones....						(3)
Gold....troy ounces..	99, 583	3, 485, 405	49, 296	1, 725, 360	68, 117	2, 384, 095
Lead....short tons..	200	30, 000	44	7, 040	11	1, 892
Mercury....flasks (76 pounds)..	786	153, 435	(2)	(2)	(2)	(2)
Ores (crude), etc.:						
Copper....short tons..	8	(4)			6	(4)
Dry and siliceous (gold and silver)....do....	1, 483, 519	(4)	381, 574	(4)	6, 506	(4)
Platinum metals (crude)....troy ounces..	27, 100	(2)	33, 616	(2)	26, 505	(2)
Sand and gravel....short tons..	(2)	(2)	712, 496	499, 269	(2)	(2)
Silver....troy ounces..	42, 788	30, 427	13, 362	9, 502	9, 983	7, 099
Stone....short tons..	(2)	(2)	(2)	(2)	(2)	(2)
Tin (metallic equivalent)....do....	(5)	70				
Tungsten ore (60-percent concentrates)....do....	10	(2)	19	(2)		
Miscellaneous [6]....		3, 285, 923		2, 350, 309		5, 910, 704
Total value, eliminating duplications....		9, 055, 000		6, 903, 000		10, 210, 000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] No canvass.
[4] Not valued as ore; value of recoverable metal content included under the metals.
[5] 135 pounds.
[6] Includes minerals indicated by "2" above.

ARIZONA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Arsenious oxide....short tons..	(1)	(1)	(1)	(1)	(1)	(1)
Asbestos....do....	1, 459	$197, 304	696	$158, 272	1, 273	$35, 039
Barite....do....	(2)	(2)				
Bismuth....pounds..	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)....		[3] 200, 000		(2 3)		(2 3)
Raw....short tons..	(2)	(2)	(2)	(2)	[4] 124, 166	[4] 204, 680
Coal....do....	11, 281	29, 711	6, 081	17, 216	7, 000	21, 000
Copper....pounds..	806, 362, 000	104, 827, 060	716, 606, 000	96, 741, 810	574, 406, 000	77, 544, 810

Diatomite......short tons..	----	----	----	----	(2)	(2)
Feldspar (crude)......long tons..	(2)	(2)	(2)	(2)	(2)	(2)
Fluorspar......short tons..	1,328	26,441	976	21,983	1,126	21,016
Gems and precious stones......	----	(5)	----	(5)	----	(5)
Gold......troy ounces..	171,810	6,013,350	112,162	3,925,670	77,223	2,702,805
Gypsum (crude)......short tons..	----	----	----	----	(2)	(2)
Iron ore......long tons..	261	(2)	----	----	----	----
Lead......short tons..	13,727	2,059,050	16,707	2,673,120	22,867	3,933,124
Lime......do....	71,044	556,345	61,091	527,792	58,736	522,609
Manganese ore......do....	5,779	140,367	8,519	223,926	1,093	45,521
Manganiferous ore......do....	498	4,336	320	6,941	56	(2)
Mercury......flasks (76 pounds)..	541	105,609	548	64,861	(2)	(2)
Mica:						
Scrap......short tons..	----	----	----	----	(2)	(2)
Sheet......pounds..	3	9	(2)	(2)	(2)	(2)
Molybdenum......do....	(2)	(2)	856,565	624,336	635,572	472,760
Ores (crude), etc.:						
Copper......short tons..	36,022,080	(6)	35,288,865	(6)	30,644,470	(6)
Dry and siliceous (gold and silver)......do....	186,185	(6)	129,086	(6)	19,506	(6)
Lead......do....	41,006	(6)	27,101	(6)	21,340	(6)
Lead-copper......do....	182	(6)	----	----	2	(6)
Zinc......do....	3,083	(6)	2,468	(6)	8,914	(6)
Zinc-copper......do....	88,883	(6)	96,603	(6)	81,123	(6)
Zinc-lead......do....	262,630	(6)	337,940	(6)	480,061	(6)
Zinc-lead-copper......do....	26,739	(6)	18,578	(6)	11,488	(6)
Quartz crystal......pounds..	(2)	(2)	(1)	(1)	----	----
Sand and gravel......short tons..	855,671	649,006	586,164	342,038	528,059	442,959
Sand and sandstone (ground)......do....	----	----	----	----	(2)	(2)
Silica (quartz)......do....	(2)	(2)	(2)	(2)	(2)	(2)
Silver......troy ounces..	5,713,889	4,063,210	4,394,039	3,124,650	3,558,216	2,530,287
Stone......short tons..	340,200	317,454	7 116,670	7 105,662	404,170	376,200
Sulfuric acid (60° B.) 8......do....	(2 9)	(2 9)	(2 9)	(2 9)	(2 9)	(2 9)
Tungsten ore (60-percent concentrates)......do....	62	99,731	29	42,763	97	(2)
Vanadium......pounds..	226,270	142,772	13,382	10,883	(2)	(2)
Zinc......short tons..	19,677	4,250,232	29,077	6,629,556	40,226	9,251,980
Miscellaneous 10......	----	1,476,873	----	791,934	----	707,383
Total value, eliminating duplications......	----	124,584,000	----	115,592,000	----	98,553,000

1 Figures not available.
2 Value included under "Miscellaneous."
3 1943-44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
4 1943-44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
5 No canvass.
6 Not valued as ore; value of recoverable metal content included under the metals.
7 Exclusive of granite and sandstone, value for which is included under "Miscellaneous."
8 From copper smelting.
9 Value not included in total value for State.
10 Includes minerals indicated by "2" and "7" above.

Mineral products of the United States, 1943–45, by States—Continued

ARKANSAS

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Aluminum ... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Barite ... do	(1)	(1)	159,686	$1,045,546	260,660	$1,934,098
Bauxite [3] ... long tons	6,486,382	$31,448,573	2,695,317	13,679,027	910,412	5,237,178
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	------	[4] 500,000	------	[4] 530,000	------	[4] 794,498
Raw ... short tons	(1)	(1)	[5] 32,727	[5] 33,177	[5] 279,397	[5] 427,038
Coal ... do	1,717,935	7,181,107	1,972,441	9,220,773	1,703,000	8,787,000
Gems and precious stones	------	(6)	------	(6)	------	(6)
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore ... long tons	144	(1)	76	(1)	------	------
Lead ... short tons	1	150	------	------	1	172
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... do	5,319	183,772	7,109	241,055	6,663	228,476
Manganiferous ore ... do	8,207	69,902	14,755	134,473	14,806	(1)
Mercury ... flasks (76 pounds)	1,532	299,062	191	22,607	(1)	(1)
Mineral waters ... gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ... M cubic feet	36,469,000	4,926,000	46,453,000	5,824,000	49,000,000	6,287,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	40,353,000	1,867,000	43,701,000	2,190,000	51,326,000	2,440,000
Liquefied petroleum gases ... do	16,484,000	335,000	31,835,000	800,000	33,075,000	890,000
Oilstones and whetstones ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ores (crude), etc.:						
Lead ... do	1	(7)	------	------	------	------
Zinc ... do	4,341	(7)	800	(7)	14,891	(7)
Petroleum ... barrels	27,600,000	27,320,000	29,418,000	30,890,000	28,613,000	30,720,000
Quartz crystal ... pounds	(1)	(1)	(8)	(8)	------	------
Sand and gravel ... short tons	[9] 2,648,986	[9] 1,715,704	2,665,688	1,805,699	2,688,622	1,930,780
Slate	------	(1)	------	6,102	------	50,000
Stone ... short tons	1,492,410	1,568,883	730,310	790,271	[10] 932,320	[10] 926,763
Strontium minerals ... do	(1)	(1)	------	------	------	------
Titanium concentrates: Rutile ... do	(1)	(1)	(1)	(1)	------	------
Tripoli ... do	(1)	(1)	(1)	(1)	------	------
Zinc ... do	96	20,736	19	4,332	303	69,690
Miscellaneous [11]	------	22,897,865	------	20,570,751	------	13,405,590
Total value, eliminating duplications	------	81,249,000	------	68,681,000	------	62,772,000

1 Value included under "Miscellaneous."
2 Value not included in total value for State.
3 1943: As shipped; 1944–45: Dried-bauxite equivalent.
4 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
5 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
6 No canvass.
7 Not valued as ore; value of recoverable metal content included under the metals.
8 Figures not available.
9 "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
10 Exclusive of sandstone, value for which is included under "Miscellaneous."
11 Includes minerals indicated by "1," "9," and "10" above.

CALIFORNIA

Aluminum .... short tons	(1 2)	(1 2)	(1 2)	(1 2)	----	----
Andalusite .... do	(1)	(1)	(1)	(1)	(1)	(1)
Antimony ore (concentrates) .... do	----	----	14	$872	----	----
Arsenious oxide .... do	(3)	(3)	(3)	(3)	(3)	(3)
Asbestos .... do	(1)	(1)	(1)	(1)	31	$2,597
Asphalt (native) .... do	(1)	(1)	(1)	(1)	(1)	(1)
Barite .... do	(1)	(1)	(1)	(1)	(1)	(1)
Boron minerals .... do	256,633	$6,401,507	277,586	6,579,587	325,935	7,635,365
Bromine .... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Calcite (Iceland spar) .... do	(1)	(1)	(1)	(1)	----	----
Calcium chloride .... short tons	7,502	110,264	7,715	119,747	7,165	126,377
Cement .... barrels	17,806,731	27,517,926	14,977,023	22,645,600	15,921,965	23,517,146
Chromite .... short tons	62,495	2,278,046	34,715	1,268,790	9,607	364,715
Clay:						
Products (other than pottery and refractories)	----	[4] 4,000,000	----	[4] 4,500,000	----	[4] 5,728,220
Raw .... short tons	[5] 580,162	[5] 1,535,944	[5] 578,236	[5] 1,454,813	[5] 1,212,372	[5] 2,111,918
Coke .... do	317,847	(1 2)	339,570	(1 2)	256,092	(1 2)
Copper .... pounds	17,524,000	2,278,120	25,442,000	3,434,670	12,946,000	1,747,710
Diatomite .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Feldspar (crude) .... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys .... short tons	(1 2)	(1 2)	(1 2)	(1 2)	5,382	(1 2)
Fluorspar .... do	134	(1)	26	650	----	----
Fuller's earth .... do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones	----	(6)	----	(6)	----	(6)
Gold .... troy ounces	148,328	5,191,480	117,373	4,108,055	147,938	5,177,830
Gypsum (crude) .... short tons	455,580	622,575	502,629	799,882	455,319	967,507
Iodine .... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Iron:						
Ore .... long tons	728,810	1,981,400	634,264	1,844,948	326,295	1,050,338
Pig .... short tons	251,109	(1 2)	384,528	(1 2)	313,883	(1 2)
Kyanite .... do	(1)	(1)	----	----	----	----
Lead .... do	5,820	873,000	5,682	909,120	7,224	1,242,528
Lime .... do	168,502	1,749,668	130,763	1,441,604	135,158	1,515,497
Lithium minerals .... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesite .... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium .... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium compounds (natural) .... pounds	155,916,000	4,451,499	140,578,000	3,218,192	109,146,000	2,642,666
Manganese ore .... short tons	23,229	(1)	21,540	712,856	1,668	78,598
Manganiferous ore .... do	8,492	(1)	4,598	44,015	12	(1)
Mercury .... flasks (76 pounds)	33,812	6,600,440	28,052	3,320,235	21,199	2,859,533
Mica, scrap .... short tons	(1)	(1)	----	----	3,582	5,373
Mineral paints (zinc and lead pigments) .... do	(1 2)	(1 2)	----	----	----	----
Mineral waters .... gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Molybdenum .... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas .... M cubic feet	457,757,000	117,963,000	502,017,000	133,484,000	510,000,000	139,850,000
Natural gasoline and allied products:						
Natural gasoline and cycle products .... gallons	582,872,000	24,287,000	632,768,000	28,530,000	724,068,000	31,775,000
Liquefied petroleum gases .... do	110,460,000	3,388,000	138,512,000	4,445,000	165,405,000	5,540,000

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

CALIFORNIA—Continued

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Ores (crude), etc.:						
Copper...short tons	265, 526	(7)	556, 378	(7)	311, 326	(7)
Dry and siliceous (gold and silver)...do	412, 793	(7)	135, 597	(7)	173, 225	(7)
Lead...do	49, 038	(7)	39, 081	(7)	26, 053	(7)
Zinc...do	8, 428	(7)	69, 204	(7)	60, 105	(7)
Zinc-copper...do	3, 435	(7)	90, 059	(7)	112, 861	(7)
Zinc-lead...do	736	(7)	35, 634	(7)	34, 399	(7)
Peat...do	3, 677	$21, 365	4, 041	$27, 895	5, 192	$46, 635
Pebbles for grinding...do	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum...barrels	284, 188, 000	298, 400, 000	311, 793, 000	330, 800, 000	326, 482, 000	347, 330, 000
Platinum metals (crude)...troy ounces	62	(1)			43	(1)
Potassium salts...short tons	(1)	(1)	(1)	(1)	(1)	(1)
Pumice...do	25, 490	160, 441	31, 409	245, 898	75, 238	481, 664
Pyrites...long tons	(1)	(1)	(1)	(1)	(1)	(1)
Quartz crystal...pounds	(1)	(1)	(3)	(3)		
Salt (sodium chloride)...short tons	596, 015	2, 839, 560	712, 558	3, 138, 185	694, 609	3, 424, 711
Sand and gravel...do	29, 025, 759	18, 548, 747	24, 228, 499	15, 171, 652	21, 599, 950	15, 176, 259
Sand and sandstone (ground)...do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz)...do	(1)	(1)	(1)	(1)	(1)	(1)
Silver...troy ounces	609, 075	433, 120	778, 936	553, 910	986, 798	701, 723
Slate		(1)		80, 959		(1)
Sodium salts (carbonates and sulfates) (natural)...short tons	257, 426	3, 146, 738	288, 012	3, 566, 183	(1)	(1)
Stone...do	8, 231, 250	6, 595, 799	[8] 9, 909, 680	[8] 9, 987, 362	9, 636, 810	8, 554, 461
Strontium minerals...do	(1)	(1)	(1)	(1)	(1)	(1)
Sulfuric acid (60° B.)[9]...do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Talc, pyrophyllite, and ground soapstone...do	58, 003	912, 291	65, 191	1, 054, 312	75, 564	1, 098, 936
Tin (metallic equivalent)...do	(1)	(1)	2	1, 970		
Tungsten ore (60-percent concentrates)...do	3, 871	5, 805, 960	3, 027	4, 558, 545	1, 073	1, 488, 289
Zinc...do	1, 856	400, 896	8, 455	1, 927, 740	9, 923	2, 282, 290
Miscellaneous[10]		43, 980, 494		43, 704, 640		23, 312, 132
Total value, eliminating duplications		565, 441, 000		607, 302, 000		627, 306, 000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures not available.
[4] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[5] 1943–44; Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of marble, value for which is included under "Miscellaneous."
[9] From lead smelting.
[10] Includes minerals indicated by "1" and "8" above.

COLORADO

Arsenious oxide short tons	(1)	(1)	(1)	(1)	(1)	(1)
Beryllium ore do	68	$8,348	35	$5,125		
Bismuth pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement barrels	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products (other than pottery and refractories)		[3] 700,000		[3] 600,000		[3] $782,003
Raw short tons	[4] 101,893	[4] 176,067	[4] 77,710	[4] 152,569	[4] 161,266	[4] 216,348
Coal do	8,324,192	27,511,918	8,167,713	29,261,076	7,668,000	27,688,000
Coke do	757,643	(2 5)	732,195	(2 5)	711,777	(2 5)
Copper pounds	2,056,000	267,280	2,096,000	282,960	2,970,000	400,950
Feldspar (crude) long tons	20,659	88,691	15,787	81,967	26,279	105,021
Ferro-alloys short tons	(2 5)	(2 5)				
Fluorspar do	49,145	1,164,868	65,209	1,604,043	52,437	1,333,735
Gems and precious stones		(6)		(6)		(6)
Gold troy ounces	137,558	4,814,530	111,455	3,900,925	100,935	3,532,725
Gypsum (crude) short tons	(2)	(2)	(2)	(2)	(2)	(2)
Iron:						
Ore long tons	39	(2)			117	(2)
Pig short tons	(2 5)	(2 5)	747,270	(2 5)	(2 5)	(2 5)
Lead do	18,032	2,704,800	17,698	2,831,680	17,044	2,931,568
Lime do	(2)	(2)	(2)	(2)	(2)	(2)
Lithium minerals do			200	8,000	(2)	(2)
Manganese ore do	707	25,688				
Manganiferous ore do					47	(2)
Mica:						
Scrap do	3,477	29,801	7,640	40,846	2,999	25,044
Sheet pounds	6	29	(2)	(2)		
Mineral waters gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Molybdenum pounds	36,940,975	27,705,730	(2)	(2)	(2)	(2)
Natural gas M cubic feet	6,445,000	1,425,000	5,141,000	1,311,000	4,800,000	1,234,000
Natural gasoline gallons	468,000	25,000	310,000	18,000	360,000	20,000
Ores (crude), etc.:						
Copper short tons	3,008	(7)	7,880	(7)	7,230	(7)
Dry and siliceous (gold and silver) do	994,826	(7)	640,864	(7)	627,523	(7)
Lead do	15,291	(7)	11,123	(7)	7,229	(7)
Lead-copper do	65	(7)				
Zinc do	4,378	(7)	5,939	(7)	151,998	(7)
Zinc-copper do					1,090	(7)
Zinc-lead do	613,750	(7)	884,616	(7)	561,782	(7)
Zinc-lead copper do					699	(7)
Peat do					(2)	(2)
Petroleum barrels	2,320,000	2,620,000	3,083,000	3,530,000	4,959,000	5,690,000
Pyrites long tons	15,215	105,473	(2)	(2)	(2)	(2)
Quartz crystal pounds	(2)	(2)	(1)	(1)		
Sand and gravel short tons	1,575,949	915,664	2,369,521	1,518,718	1,800,405	1,147,027
Silver troy ounces	2,664,142	1,894,501	2,248,830	1,599,168	2,226,780	1,583,488
Stone short tons	880,430	662,804	680,620	568,095	671,620	923,797
Sulfur ore long tons	(2)	(2)	89	1,200	126	5,670

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

COLORADO—Continued

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Tantalum and columbium ores ... pounds	2,225	$2,307				
Tungsten ore (60-percent concentrates) ... short tons	378	619,802	296	$433,303	234	$222,428
Vanadium ... pounds	4,159,830	2,610,207	3,058,727	1,288,326	2,701,103	1,609,884
Vermiculite ... short tons	356	2,529	1,189	11,890	(2)	(2)
Zinc ... do	44,094	9,524,304	39,955	9,109,740	35,773	8,227,790
Miscellaneous[8]		21,915,563		40,868,418		37,916,713
Total value, eliminating duplications		88,534,000		80,202,000		76,862,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] Value not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Includes minerals indicated by "2" above.

CONNECTICUT

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Beryllium ore ... short tons			(1)	(1)		
Clay:						
Products (other than pottery and refractories)		[2] $850,000		[2] $700,000		[2] $925,933
Raw ... short tons					[3] 63,825	[3] 47,597
Coke ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Feldspar (crude) ... long tons	11,618	76,463	11,390	75,394	11,705	74,778
Lime ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium ... do	(1)	(1)	3,441	1,458,800	844	346,100
Mica:						
Scrap ... do	304	6,795	593	13,798	70	1,752
Sheet ... pounds	202,142	65,239	77,076	147,129	61,832	10,125
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Peat ... short tons					2,938	15,642
Sand and gravel ... do	1,729,052	837,069	1,587,268	784,572	1,611,216	841,509
Stone ... do	1,184,950	1,392,215	1,029,790	1,213,543	817,670	1,166,288
Miscellaneous[6]		6,081,856		4,898,030		4,838,510
Total value, eliminating duplications		4,835,000		4,496,000		3,492,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimated by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Includes minerals indicated by "1" above.

DELAWARE

Clay:						
Products (other than pottery and refractories)		[1] $200,000		[1] $120,000		([1] [2])
Raw ... short tons	([2])	([2])			[3] 6,040	[3] $6,040
Sand and gravel ... do	186,923	99,409	88,445	47,269	82,674	43,678
Stone ... do	([2])	([2])	9,970	14,958		
Miscellaneous		67,461				86,897
Total value, eliminating duplications		367,000		182,000		131,000

[1] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[2] Value included under "Miscellaneous."

[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

DISTRICT OF COLUMBIA

Clay:						
Products (other than pottery and refractories)		([1] [2])		([1] [2])		([1] [2])
Raw ... short tons					([2])	([2])
Miscellaneous		$100,000		$111,000		$266,137
Total value, eliminating duplications		100,000		111,000		229,000

[1] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[2] Value included under "Miscellaneous."

FLORIDA

Cement ... barrels	([1])	([1])	([1])	([1])	([1])	([1])
Clay:						
Products (other than pottery and refractories)		[2] $150,000		([1] [2])		([1] [2])
Raw ... short tons	([1])	([1])	([1])	([1])	[3] 61,204	[3] $332,662
Diatomite ... do	([1])	([1])				
Fuller's earth ... do	([1])	([1])	([1])	([1])	([1])	([1])
Lime ... do	20,507	202,276	17,959	$185,565	18,431	211,077
Mineral waters ... gallons sold	([4])	([4])	([4])	([4])	([4])	([4])
Natural gas ... M cubic feet			6,000	([1])	6,000	([1])
Peat ... short tons	([1])	([1])	([1])	([1])	16,731	131,303
Petroleum ... barrels	4,000	4,000	12,000	([1])	30,000	([1])
Phosphate rock ... long tons	3,588,493	12,089,477	3,752,795	13,534,947	4,238,228	16,298,474
Sand and gravel ... short tons	1,833,453	1,527,985	1,335,569	1,180,299	1,314,011	1,074,055
Stone ... do	[5] 8,741,200	[5] 7,446,388	2,730,020	2,600,462	[5] 2,617,180	[5] 3,024,465
Titanium concentrates:						
Ilmenite ... do	([1])	([1])	([1])	([1])	([1])	([1])
Rutile ... do	([1])	([1])	([1])	([1])	([1])	([1])
Zircon ... do	([1])	([1])	([1])	([1])	([1])	([1])
Miscellaneous [6]		3,649,493		4,350,439		3,944,033
Total value, eliminating duplications		25,070,000		21,852,000		24,995,000

[1] Value included under "Miscellaneous."

[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

[4] No canvass.

[5] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[6] Includes minerals indicated by "1" and "5" above.

Mineral products of the United States, 1943–45, by States—Continued

GEORGIA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Asbestos ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite ... do	98,680	$621,193	108,851	$929,090	110,393	$1,056,035
Bauxite ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] 2,000,000		(1 2)		(1 2)
Raw ... short tons	[3] 771,862	[3] 6,275,935	[3] 704,642	[3] 5,854,021	[3] 1,256,664	[3] 7,108,321
Coal ... do	14,385	54,409	24,285	92,629	32,000	132,000
Fuller's earth ... do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		(4)		(4)		(4)
Gold ... troy ounces	12	420	5	175		
Iron ore ... long tons	413,459	950,211	285,523	687,494	276,050	616,524
Kyanite ... short tons	(1)	(1)				
Lime ... do	8,513	59,514	6,079	45,315	3,864	32,797
Magnesium sulfate (natural) ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... short tons	2,489	(1)	1,135	(1)	1,056	25,387
Manganiferous ore ... do	5,835	64,658	2,232	25,762		
Mica:						
Scrap ... do	6,251	39,336	5,305	107,135	616	14,780
Sheet ... pounds	212,554	195,822	60,112	119,342	30,960	41,594
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Quartz crystal ... pounds	(1)	(1)	(5)	(5)		
Sand and gravel ... short tons	655,335	467,440	569,908	416,871	605,036	350,264
Sand and sandstone (ground) ... do	3,252	32,525	3,090	19,823	7,190	27,858
Slate		(1)		(1)		(1)
Stone ... short tons	2,178,510	5,373,879	1,773,150	5,037,596	[6] 1,514,710	[6] 4,799,320
Talc ... do	35,210	396,031	30,425	363,342	32,433	296,163
Miscellaneous [7]		4,395,340		5,273,632		5,867,321
Total value, eliminating duplications		20,927,000		18,972,000		19,939,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Figures not available.
[6] Exclusive of crushed unclassified stone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

IDAHO

Antimony ore (concentrates)	short tons	15,658	$862,214	12,133	$532,906	14,465	$545,334
Arsenious oxide	do	(1)	(1)	(1)	(1)	(1)	(1)
Bismuth	pounds	(1)	(1)	(1)	(1)	(1)	(1)
Cement	barrels	(2)	(2)	(2)	(2)	(2)	(2)
Clay:							
Products (other than pottery and refractories)			[3] 100,000		(2 3)		(2 3)
Raw	short tons	(2)	(2)	(2)	(2)	[4] 9,635	[4] 14,648
Copper	pounds	4,648,000	604,240	3,376,000	455,760	3,096,000	417,960
Diatomite	short tons	(2)	(2)	(2)	(2)		
Garnet, abrasive	do	(2)	(2)	(2)	(2)	(2)	(2)
Gems and precious stones			(5)		(5)		(5)
Gold	troy ounces	30,808	1,078,280	25,008	875,280	17,780	622,300
Lead	short tons	96,457	14,468,550	83,530	13,364,800	68,447	11,772,884
Manganese ore	do	36	(2)				
Mercury	flasks (76 pounds)	4,261	831,790	(2)	(2)	627	84,576
Mica:							
Scrap	short tons	(2)	(2)	356	7,161	199	3,178
Sheet	pounds	5,136	25,554	48,787	247,149	48,018	111,008
Ores (crude), etc.:							
Copper	short tons	329	(6)	3,232	(6)	8,569	(6)
Dry and siliceous (gold and silver)	do	531,445	(6)	365,247	(6)	235,188	(6)
Lead	do	237,122	(6)	252,944	(6)	107,511	(6)
Lead-copper	do	68	(6)	39	(6)	67	(6)
Zinc	do	44,382	(6)	128,982	(6)	100,039	(6)
Zinc-lead	do	1,928,401	(6)	2,520,594	(6)	2,687,912	(6)
Phosphate rock	long tons	108,916	561,630	112,565	584,400	123,340	673,627
Pumice	short tons					(2)	(2)
Quartz crystal	pounds	(2)	(2)	(1)	(1)		
Sand and gravel	short tons	4,699,745	4,276,960	1,494,646	788,798	1,597,112	952,971
Silver	troy ounces	11,700,180	8,320,128	9,931,614	7,062,481	8,142,667	5,790,341
Stone	short tons	91,330	127,092	[7] 323,000	[7] 413,805	247,140	293,980
Tungsten ore (60-percent concentrates)	do	4,648	(2)	4,005	(2)	2,130	(2)
Vanadium	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Zinc	short tons	86,707	18,728,712	91,372	20,832,816	83,463	19,196,490
Miscellaneous [8]			7,489,981		6,155,499		3,870,822
Total value, eliminating duplications			57,475,000		51,321,000		44,348,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of granite, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "2" and "7" above.

Mineral products of the United States, 1943–45, by States—Continued

ILLINOIS

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	4,307,278	$6,657,889	3,419,815	$5,325,796	4,189,449	$7,089,118
Clay:						
Products (other than pottery and refractories)		[1] 4,500,000		[1] 4,000,000		[1] 6,578,677
Raw ... short tons	[2] 204,860	[2] 385,108	[2] 216,917	[2] 344,181	[2] 1,366,815	[2] 1,529,760
Coal ... do	72,631,270	154,778,263	76,791,449	171,382,887	72,525,000	171,159,000
Coke ... do	3,625,457	[3] 29,416,984	3,878,764	[3] 34,074,422	3,681,516	[3] 32,377,629
Ferro-alloys ... do	(3 4)	(3 4)				
Fluorspar ... do	198,789	6,292,789	176,259	5,954,991	147,251	5,014,807
Fuller's earth ... do	39,500	372,024	42,277	390,346	43,664	403,084
Iron, pig ... do	5,920,894	[3] 126,910,295	5,686,397	[3] 118,953,078	5,061,368	[3] 116,303,897
Lead ... do	2,043	306,450	1,971	315,360	3,005	516,860
Lime ... do	314,736	2,386,554	290,988	2,266,539	287,607	2,229,335
Marl, calcareous ... do	(4)	(4)	14,485	10,596	10,119	7,464
Mineral paints (zinc and lead pigments) ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	18,120,000	2,857,000	18,137,000	2,942,000	18,100,000	2,990,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	71,737,000	4,072,000	61,351,000	3,870,000	55,233,000	3,330,000
Liquefied petroleum gases ... do	113,750,000	3,358,000	133,018,000	4,130,000	120,683,000	3,980,000
Ores (crude), etc.:						
Lead ... short tons	1	(6)				
Zinc ... do	13,091	(6)	28,137	(6)	73,312	(6)
Zinc-lead ... do	84,787	(6)	136,907	(6)	203,947	(6)
Peat ... do	(4)	(4)	(4)	(4)	(4)	(4)
Petroleum ... barrels	82,260,000	112,700,000	77,413,000	107,370,000	75,210,000	105,390,000
Pyrites ... long tons	12,968	23,966	8,259	15,262	6,861	12,680
Sand and gravel ... short tons	13,722,449	9,882,322	12,317,626	8,922,068	12,613,555	8,606,155
Sand and sandstone (ground) ... do	164,401	1,180,469	158,673	1,098,275	144,212	1,003,273
Silver ... troy ounces	2,153	1,531	2,437	1,733	2,198	1,563
Stone ... short tons	11,137,960	10,762,707	10,680,640	10,700,140	10,950,940	11,384,625
Sulfuric acid (60° B.) [7] ... do	259,302	[3] 2,561,904	234,245	[3] 2,328,395	216,482	[3] 2,186,468
Tripoli ... do	10,203	168,758	12,031	205,732	11,144	184,189
Zinc ... do	5,851	1,263,816	7,262	1,655,736	8,310	1,911,300
Miscellaneous [8]		4,919,248		6,046,431		5,306,596
Total value, eliminating duplications		322,050,000		330,971,000		332,489,000

[1] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[2] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[3] Value not included in total value for State.
[4] Value included under "Miscellaneous."
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] From zinc smelting.
[8] Includes minerals indicated by "4" above.

INDIANA

Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $3,000,000		[2] $2,800,000		[2] $3,405,844
Raw ... short tons	[3] 93,822	[3] 96,849	[3] 88,397	[3] 99,625	[3] 434,530	[3] 429,868
Coal ... do	25,064,583	52,391,175	27,961,883	62,917,512	25,500,000	58,905,000
Coke ... do	8,111,916	[4] 66,259,831	8,821,021	[4] 74,079,053	7,814,247	[4] 68,458,007
Ferro-alloys ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Iron, pig ... do	6,722,095	[4] 150,497,458	6,857,453	[4] 153,676,643	5,981,937	[4] 138,253,310
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Marl, calcareous ... do	9,904	7,233	12,400	4,064	22,705	8,766
Mineral paints (zinc and lead pigments) ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	1,450,000	1,142,000	1,014,000	794,000	1,100,000	862,000
Petroleum ... barrels	5,283,000	7,130,000	5,118,000	7,080,000	4,868,000	6,890,000
Pyrites ... long tons	3,906	7,544	(1)	(1)	(1)	(1)
Rubbing stones, scythestones, and whetstones ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	8,062,568	4,535,533	6,885,125	3,985,239	6,947,958	4,115,842
Stone ... do	5,381,940	5,570,790	4,102,140	4,562,399	4,187,110	6,293,019
Sulfuric acid (60° B.)[6] ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [7]		16,875,235		10,653,975		12,303,176
Total value, eliminating duplications		83,513,000		90,465,000		90,061,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] From zinc-roasting operation.
[7] Includes minerals indicated by "1" above.

IOWA

Cement ... barrels	3,912,307	$6,335,173	3,408,616	$5,677,787	3,527,838	$6,220,991
Clay:						
Products (other than pottery and refractories)		[1] 2,300,000		[1] 2,300,000		[1] 3,578,199
Raw ... short tons	[2] 12,489	[2] 36,959	[2] 3,705	[2] 31,373	[2] 455,186	[2] 401,870
Coal ... do	2,770,610	8,575,522	2,140,936	7,499,909	2,010,000	6,995,000
Ferro-alloys ... do	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)	(3 4)
Gypsum (crude) ... do	418,092	595,602	398,143	655,392	430,843	569,964
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Peat ... short tons	(3)	(3)	(3)	(3)	(3)	(3)
Sand and gravel ... do	5,070,927	1,979,559	5,271,031	2,084,149	6,030,531	2,091,391
Stone ... do	3,544,560	4,327,782	[6] 3,563,020	[6] 4,175,005	[6] 4,026,460	[6] 5,306,299
Miscellaneous [7]		6,598,571		5,198,788		5,469,648
Total value, eliminating duplications		24,187,000		22,462,000		24,820,000

[1] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[2] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[3] Value included under "Miscellaneous."
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension limestone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "3" and "6" above.

Mineral products of the United States, 1943–45, by States—Continued

KANSAS

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Cement ... barrels	[1] 5,305,798	[1] $8,035,559	[1] 2,866,946	[1] $4,454,060	[1] 3,298,923	[1] $5,157,991
Clay:						
Products (other than pottery and refractories)		[2] 700,000		[2] 1,100,000		[2] 1,593,981
Raw ... short tons	(3)	(3)	(3)	(3)	[4] 254,764	[4] 196,950
Coal ... do	3,436,781	8,606,968	3,369,087	8,684,865	2,890,000	7,109,000
Gypsum (crude) ... do	(3)	(3)	(3)	(3)	(3)	(3)
Helium ... cubic feet			[5] 38,140,320	[5] 239,140	[5] 58,632,455	[5] 477,268
Lead ... short tons	9,213	1,381,950	9,394	1,503,040	7,370	1,267,640
Mineral paints (zinc and lead pigments) ... do	(3 6)	(3 6)	(3 6)	(3 6)	(3 6)	(3 6)
Mineral waters ... gallons sold	(7)	(7)	(7)	(7)	(7)	(7)
Natural gas ... M cubic feet	133,729,000	49,618,000	157,733,000	55,613,000	145,000,000	52,400,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	70,325,000	2,967,000	54,045,000	2,600,000	59,021,000	2,680,000
Liquefied petroleum gases ... do	14,881,000	471,000	15,789,000	525,000	14,279,000	500,000
Ores (crude), etc.:						
Zinc ... short tons	2,232,495	(8)	2,351,168	(8)	2,276,525	(8)
Zinc-lead ... do	2,243,272	(8)	2,878,627	(8)	2,299,854	(8)
Petroleum ... barrels	106,178,000	127,410,000	98,762,000	120,290,000	95,997,000	119,180,000
Pumice ... short tons	43,918	163,366	43,034	163,538	47,484	187,651
Salt ... do	945,287	4,197,507	932,238	4,357,217	855,806	3,837,850
Sand and gravel ... do	3,615,861	2,103,091	2,786,088	1,602,778	3,082,392	1,674,742
Stone ... do	2,074,580	2,291,198	2,121,020	2,069,738	[9] 3,666,000	[9] 2,847,200
Zinc ... do	56,944	12,299,904	63,703	14,524,284	48,394	11,130,620
Miscellaneous [10]		2,601,179		3,718,761		3,546,238
Total value, eliminating duplications		220,413,000		217,876,000		210,187,000

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] Value included under "Miscellaneous."
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] Figures cover fiscal year ended June 30 of year stated.
[6] Value not included in total value for State.
[7] No canvass.
[8] Not valued as ore; value of recoverable metal content included under the metals.
[9] Exclusive of dimension sandstone, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1," "3," and "9" above.

KENTUCKY

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Asphalt (native) ... short tons	(1)	(1)	141,208	$978,279	152,047	$1,037,068
Barite ... do	37	$207				
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] 1,000,000		[2] 900,000		[2] 1,162,696
Raw ... short tons	[3] 404,278	[3] 1,657,398	[3] 372,606	[3] 1,609,478	[3] 485,494	[3] 1,843,987
Coal ... do	63,211,473	170,769,859	71,355,997	208,797,140	67,875,000	201,088,000

Coke ..... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Fluorspar ..... do	109,849	3,122,513	112,791	3,363,788	95,142	2,832,945
Iron, pig ..... do	706,253	(1 4)	728,588	(1 4)	631,105	(1 4)
Lead ..... do	240	36,000	170	27,200	129	22,188
Mineral waters ..... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ..... M cubic feet	92,364,000	39,831,000	94,223,000	40,392,000	89,000,000	38,400,000
Natural gasoline and allied products:						
Natural gasoline ..... gallons	10,571,000	545,000	10,997,000	650,000	9,376,000	517,000
Liquefied petroleum gases ..... do	32,746,000	675,000	37,745,000	900,000	38,061,000	850,000
Ores (crude), etc.:						
Zinc ..... short tons	-----	-----	715	(6)	-----	-----
Zinc-lead ..... do	23,818	(6)	17,230	(6)	6,836	(6)
Petroleum ..... barrels	7,883,000	10,800,000	9,621,000	13,640,000	10,325,000	15,260,000
Sand and gravel ..... short tons	2,298,328	1,452,298	1,502,096	991,072	1,174,510	1,033,424
Stone ..... do	4,621,720	4,309,201	3,566,920	3,472,065	[7] 3,470,770	[7] 3,740,716
Zinc ..... do	931	201,096	341	77,748	182	41,860
Miscellaneous [8]	-----	18,182,911	-----	19,946,258	-----	17,165,075
Total value, eliminating duplications	-----	236,578,000	-----	276,701,000	-----	268,858,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of dimension limestone, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

LOUISIANA

Cement ..... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	-----	[2] $700,000	-----	[2] $400,000	-----	[2] $485,710
Raw ..... short tons	(1)	(1)	(1)	(1)	[3] 66,891	[3] 69,357
Lime ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters ..... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas ..... M cubic feet	505,294,000	87,829,000	534,688,000	88,660,000	545,000,000	91,780,000
Natural gasoline and allied products:						
Natural gasoline and cycle products ..... gallons	265,807,000	10,614,000	409,824,000	18,635,000	426,941,000	19,520,000
Liquefied petroleum gases ..... do	40,255,000	1,160,000	82,835,000	2,665,000	121,961,000	4,150,000
Petroleum ..... barrels	123,592,000	150,510,000	129,645,000	158,600,000	130,566,000	160,530,000
Salt ..... short tons	1,620,382	3,678,068	1,843,728	4,102,020	1,867,689	4,465,643
Sand and gravel ..... do	3,835,749	3,046,172	2,646,789	2,101,274	2,797,571	2,585,945
Sand and sandstone (ground) ..... do	-----	-----	(1)	(1)	-----	-----
Stone ..... do	(1)	(1)	1,079,150	824,681	1,000,040	756,341
Sulfur ..... long tons	567,936	9,086,976	644,605	10,313,680	763,479	12,215,664
Miscellaneous [5]	-----	2,787,459	-----	2,072,232	-----	2,323,193
Total value, eliminating duplications	-----	269,412,000	-----	288,374,000	-----	298,842,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

Mineral products of the United States, 1943–45 by States—Continued

MAINE

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Beryllium ore — short tons	2	$169	2	$257		
Cement — barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] 120,000		(1 2)		(1 2)
Raw — short tons					[3] 8,882	[3] $5,756
Feldspar (crude) — long tons	6,748	41,652	8,011	47,892	10,974	62,287
Gems and precious stones		(4)		(4)		(4)
Lime — short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals — do			(1)	(1)		
Mica:						
Scrap — do	240	5,862	64	1,602	32	768
Sheet — pounds	51,576	63,845	28,008	40,803	(1)	(1)
Mineral waters — gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Peat — short tons	1,871	60,033	2,276	80,732	1,032	37,662
Sand and gravel — do	1,603,324	733,503	1,940,966	710,047	1,888,778	771,724
Silica (quartz) — do	140	840	88	203	4	10
Slate		(1)		(1)		(1)
Stone — short tons	201,450	409,780	[5] 125,840	[5] 332,736	[5] 112,920	[5] 382,414
Miscellaneous [6]		1,284,761		932,131		1,228,227
Total value, eliminating duplications		2,720,000		2,146,000		2,483,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Exclusive of basalt, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

MARYLAND

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Cement — barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $1,400,000		(1 2)		(1 2)
Raw — short tons	[3] 50,547	[3] 133,531	[3] 37,946	[3] $156,562	[3] 208,229	[3] $360,181
Coal — do	1,933,380	5,812,523	1,870,502	6,410,769	1,765,000	6,107,000
Coke — do	2,059,839	(1 4)	2,058,233	(1 4)	2,024,609	(1 4)
Iron, pig — do	2,526,748	(1 4)	2,514,735	(1 4)	2,244,964	(1 4)
Lime — do	78,386	530,989	69,514	534,743	66,675	502,376

Mica, scrap ... do	(1)	(1)				
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Potassium salts ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	4,658,609	4,115,389	3,279,307	2,792,183	2,898,808	2,694,876
Silica (quartz) ... do	827	12,737	(1)	(1)	(1)	(1)
Slate		(1)		(1)		(1)
Stone ... short tons	1,423,970	2,029,927	[6] 1,272,480	[6] 1,756,318	[6] 1,242,930	[6] 1,851,828
Talc and ground soapstone ... do	(1)	(1)	17,130	161,222	14,707	149,170
Miscellaneous [7]		71,645,840		74,377,780		70,890,717
Total value, eliminating duplications		17,508,000		15,264,000		15,030,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension limestone in 1944 and of crushed unclassified stone in 1945, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

MASSACHUSETTS

Beryllium ore ... short tons	(1)	(1)	4	$656		
Clay:						
Products (other than pottery and refractories)		[2] $500,000		[2] 500,000		[2] $506,848
Raw ... short tons	(1)	(1)	(1)	(1)	[3] 54,805	[3] 46,895
Coke ... do	1,174,152	(1 4)	1,177,850	(1 4)	1,149,448	(1 4)
Iron, pig ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Lime ... do	94,877	783,999	87,295	745,573	94,499	816,733
Mica:						
Scrap ... do	(1)	(1)	118	2,949	(1)	(1)
Sheet ... pounds	15,063	15,166	(1)	(1)		
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Peat ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	3,321,047	1,941,241	2,825,533	1,697,649	2,928,420	1,696,387
Sand and sandstone (ground) ... do	3,148	16,050	2,500	12,000	2,350	11,600
Silica (quartz) ... do	1,037	7,259			696	6,349
Stone ... do	[6] 1,370,460	[6] 2,170,408	1,284,070	2,287,050	1,283,310	2,393,390
Miscellaneous [7]		15,574,028		13,424,184		12,870,744
Total value, eliminating duplications		5,441,000		5,260,000		5,447,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of sandstone, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

Mineral products of the United States, 1943–45, by States—Continued

MICHIGAN

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Bromine ... pounds	19,846,772	$5,447,266	17,264,185	$4,918,686	(1)	(1)
Calcium chloride ... short tons	175,926	1,384,818	175,740	1,441,882	(1)	(1)
Cement ... barrels	6,430,404	9,285,815	5,177,176	7,733,185	6,243,322	$9,937,834
Clay:						
Products (other than pottery and refractories)		[2] 1,500,000		[2] 1,000,000		[2] 1,248,901
Raw ... short tons	[3] 148,178	[3] 117,353	(1)	(1)	[3] 603,778	[3] 468,417
Coal ... do	168,615	820,995	139,938	762,529	125,000	723,000
Coke ... do	2,948,389	[4] 22,006,821	3,005,424	[4] 24,848,937	2,805,970	[4] 24,119,361
Copper ... pounds	93,528,000	12,158,640	84,842,000	11,453,670	60,802,000	8,208,270
Gems and precious stones		(5)		(5)		(5)
Gypsum (crude) ... short tons	538,602	737,719	552,672	891,965	640,186	862,028
Iron:						
Ore ... long tons	14,510,357	40,258,096	13,693,377	38,537,000	11,833,055	35,313,135
Pig ... short tons	1,492,942	[4] 24,782,464	1,617,912	(1 4)	1,482,037	[4] 26,079,628
Lime ... do	96,554	717,401	119,446	869,337	(1)	(1)
Magnesium ... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium compounds (natural) ... pounds	241,124,000	4,446,052	269,948,000	6,031,551	98,444,000	2,591,861
Manganiferous ore ... short tons	100,092	(1)	45,689	(1)	1,680	(1)
Marl, calcareous ... do	16,004	10,770	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	18,006,000	12,567,000	19,653,000	14,059,000	21,300,000	15,260,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	1,226,000	59,000	4,055,000	210,000	5,369,000	260,000
Liquefied petroleum gases ... do			4,445,000	147,000	8,092,000	480,000
Ores (crude), etc.: Copper ... short tons	4,403,594	(6)	5,410,238	(6)	5,196,932	(6)
Peat ... do	(1)	(1)	(1)	(1)	5,320	51,578
Petroleum ... barrels	20,768,000	29,280,000	18,490,000	26,410,000	17,259,000	25,250,000
Salt ... short tons	4,284,685	14,472,820	4,287,758	14,921,719	4,285,493	14,942,443
Sand and gravel ... do	11,750,989	5,588,850	12,184,583	6,103,136	12,199,977	6,107,890
Silver ... troy ounces	48,479	34,474	54,218	38,555	21,863	15,547
Stone ... short tons	15,919,780	9,669,672	15,789,320	8,709,353	[7] 15,493,790	[7] 9,027,267
Miscellaneous [8]		8,459,065		35,733,578		10,334,181
Total value, eliminating duplications		157,016,000		152,135,000		140,677,000

[1] Value included under "Miscellaneous."

[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

[4] Value not included in total value for State.

[5] No canvass.

[6] Not valued as ore; value of recoverable metal content included under the metals.

[7] Exclusive of dimension limestone, value for which is included under "Miscellaneous."

[8] Includes minerals indicated by "1" and "7" above.

MINNESOTA

Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			[2] $600,000		(1 2)		(1 2)
Raw	short tons	(1)	(1)	(1)	(1)	[3] 13,220	[3] $19,717
Coke	do	956,396	[4] 8,076,109	894,095	[4] $7,973,653	825,620	[4] 7,760,362
Ferro-alloys	do	(1 4)	(1 4)	(1 4)	(1 4)		
Flint lining for tube mills	do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones			(5)		(5)		(5)
Iron:							
Ore	long tons	68,634,724	168,536,802	65,448,402	160,853,166	61,569,976	156,942,255
Pig	short tons	532,761	(1 4)	565,775	(1 4)	465,314	(1 4)
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Manganiferous ore	do	1,505,054	(1)	1,267,552	(1)	1,406,847	(1)
Marl, calcareous	do	(1)	(1)	11,930	3,098	2,970	2,200
Millstones							(1)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Peat	short tons	4,264	58,843	(1)	(1)	(1)	(1)
Pebbles for grinding	do	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel	do	8,575,915	2,105,143	9,704,152	2,106,804	9,125,117	2,402,530
Stone	do	[6] 658,600	[6] 1,205,910	[6] 1,316,790	[6] 2,245,814	1,173,800	1,962,394
Miscellaneous [7]			17,812,178		17,630,244		16,266,920
Total value, eliminating duplications			177,687,000		170,465,000		167,140,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of basalt and marble in 1943, and of marble and unclassified stone in 1944, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

MISSISSIPPI

Clay:							
Products (other than pottery and refractories)			[1] $700,000		[1] $600,000		[1] $759,400
Raw	short tons	(2)	(2)	(2)	(2)	[3] 212,199	[3] 432,546
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	1,461,000	385,000	1,352,000	336,000	3,200,000	672,000
Petroleum	barrels	18,807,000	18,430,000	16,337,000	16,730,000	18,775,000	19,230,000
Sand and gravel	short tons	[5] 1,855,207	[5] 1,098,745	1,802,479	877,370	1,606,345	812,046
Stone	do	(2)	(2)	(2)	(2)	(2)	(2)
Miscellaneous [6]			564,665		397,115		27,761
Total value, eliminating duplications			21,178,000		18,940,000		21,816,000

[1] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[2] Value included under "Miscellaneous."
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[6] Includes minerals indicated by "2" and "5" above.

Mineral products of the United States, 1943–45, by States—Continued

MISSOURI

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Asphalt (native) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Barite ... do	124,147	$872,044	150,748	$1,121,678	225,467	$1,841,959
Cement ... barrels	4,464,943	7,024,285	3,061,434	4,881,516	3,681,632	6,134,452
Clay:						
Products (other than pottery and refractories)		[2] 1,600,000		[2] 1,400,000		[2] 1,462,818
Raw ... short tons	[3] 1,245,492	[3] 2,540,557	[3] 927,770	[3] 1,805,495	[3] 1,355,349	[3] 2,311,660
Coal ... do	4,309,636	10,755,849	4,778,652	12,315,606	4,105,000	10,098,000
Cobalt ... pounds			(1)	(1)	(1)	(1)
Coke ... short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Copper ... pounds	2,680,000	348,400	6,604,000	891,540	6,798,000	917,730
Iron ore ... long tons	52,893	153,997	19,293	99,560	112,668	(1)
Lead ... short tons	184,910	27,736,500	174,683	27,949,280	176,575	30,370,900
Lime ... do	963,301	6,046,453	908,340	5,820,028	753,932	5,031,222
Manganese ore ... do	180	(1)				
Mineral paints (zinc and lead pigments) ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	124,000	67,000	159,000	84,000	100,000	53,000
Nickel ... short tons			(1)	(1)	(1)	(1)
Ores (crude), etc.:						
Lead ... do	6,832,794	(6)	6,423,705	(6)	6,509,287	(6)
Lead-copper ... do			122,856	(6)	167,485	(6)
Zinc ... do	1,244,418	(6)	876,198	(6)	849,836	(6)
Zinc-lead ... do	1,362,939	(6)	1,758,333	(6)	1,131,228	(6)
Petroleum ... barrels	36,000	41,000	45,000	(1)	45,000	(1)
Sand and gravel ... short tons	3,250,533	2,298,556	3,183,176	2,370,261	3,489,775	2,780,467
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silver ... troy ounces	111,285	79,136	92,243	65,595	94,822	67,429
Stone ... short tons	5,636,040	5,864,005	4,856,540	5,312,384	[7] 5,314,160	[7] 6,055,747
Sulfuric acid (60°B.) [8] ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Tripoli ... do	(1)	(1)	(1)	(1)	6,542	114,188
Tungsten ore (60-percent concentrates) ... do	1	(1)	1	(1)		
Zinc ... do	30,413	6,569,208	36,626	8,350,728	22,175	5,100,250
Miscellaneous [9]		3,299,888		3,687,908		5,214,889
Total value, eliminating duplications		72,212,000		72,960,000		74,171,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of sandstone, value for which is included under "Miscellaneous."
[8] From zinc smelting.
[9] Includes minerals indicated by "1" and "7" above.

MONTANA

Arsenious oxide ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Bismuth ... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Calcite (Iceland spar) ... do	(1)	(1)	(1)	(1)	---	---
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Chromite ... short tons	75,691	$1,981,983	1,251	$22,957	---	---
Clay:						
Products (other than pottery and refractories)	---	[3] 150,000	---	(1 3)	---	(1 3)
Raw ... short tons	(1)	(1)	(1)	(1)	[4] 24,778	[4] $33,778
Coal:						
Bituminous ... do	4,768,666	8,315,468	4,792,340	9,163,421	} 4,550,000	8,645,000
Lignite ... do	64,383	139,000	51,709	113,000		
Copper ... pounds	269,050,000	34,976,500	236,380,000	31,911,300	177,012,000	23,896,620
Gems and precious stones	---	(5)	---	(5)	---	(5)
Gold ... troy ounces	59,586	2,085,510	50,021	1,750,735	44,597	1,560,895
Graphite, crystalline ... pounds	(1)	(1)	114,000	7,960	---	---
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Lead ... do	16,324	2,448,600	13,105	2,096,800	9,999	1,719,828
Lime ... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore ... do	138,115	(1)	159,889	5,985,002	151,930	6,146,595
Manganiferous ore ... do	2,041	(1)	781	15,999	5,057	(1)
Mica, sheet ... pounds	(1)	(1)	(1)	(1)		
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas ... M cubic feet	31,562,000	8,006,000	32,102,000	8,248,000	31,800,000	8,214,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	2,749,000	180,000	2,886,000	200,000	2,969,000	195,000
Liquefied petroleum gases ... do	1,915,000	110,000	1,882,000	110,000	1,930,000	100,000
Ores (crude), etc.:						
Copper ... short tons	5,068,865	(6)	5,340,862	(6)	4,463,131	(6)
Dry and siliceous (gold and silver) ... do	266,972	(6)	231,399	(6)	188,713	(6)
Lead ... do	8,449	(6)	16,857	(6)	14,919	(6)
Zinc ... do	234,361	(6)	201,470	(6)	87,801	(6)
Zinc-lead ... do	294,369	(6)	258,874	(6)	164,998	(6)
Petroleum ... barrels	7,916,000	9,500,000	8,647,000	10,700,000	8,397,000	10,860,000
Phosphate rock ... long tons	119,764	488,665	186,434	761,745	150,858	916,288
Platinum metals (crude) ... troy ounces	---	---	9	(1)	---	---
Pyrites ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	2,553,080	1,155,621	4,308,811	1,956,449	[7] 2,035,192	[7] 1,067,295
Silver ... troy ounces	8,450,370	6,009,152	7,093,215	5,044,064	5,942,070	4,225,472
Stone ... short tons	509,540	365,777	[8] 232,090	[8] 229,160	646,850	563,374
Talc ... do	(1)	(1)	(1)	(1)	(1)	(1)
Tungsten ore (60-percent concentrates) ... do	---	---	25	(1)	(9)	(1)
Vermiculite ... do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc ... do	37,606	8,122,896	36,127	8,236,956	17,403	4,002,690
Miscellaneous [10]	---	7,707,793	---	2,498,254	---	3,693,239
Total value, eliminating duplications	---	91,743,000	---	89,052,000	---	75,816,000

[1] Value included under "Miscellaneous."
[2] Figures not available.
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[8] Exclusive of dimension basalt, value for which is included under "Miscellaneous."
[9] 147 pounds.
[10] Includes minerals indicated by "1," "7," and "8" above.

Mineral products of the United States, 1943–45, by States—Continued

NEBRASKA

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $400,000		[2] $320,000		[2] $281,357
Raw ... short tons	[3] 12,737	[3] 14,754	(1)	(1)	[3] 36,415	[3] 34,757
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Petroleum ... barrels	635,000	579,000	417,000	460,000	305,000	360,000
Pumice ... short tons	(1)	(1)	6,083	51,043	6,764	59,735
Sand and gravel ... do	4,526,510	2,391,463	3,894,983	1,896,777	3,882,461	1,956,560
Stone ... do	538,380	968,932	169,720	483,563	297,750	622,671
Miscellaneous		2,454,833		1,848,814		1,671,419
Total value, eliminating duplications		6,800,000		5,060,000		4,953,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.

NEVADA

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Antimony ore (concentrates) ... short tons	84	$5,372	74	$6,593	65	$6,402
Arsenious oxide ... do	(1)	(1)	(1)	(1)	(1)	(1)
Barite ... do	12,157	49,900	22,390	84,859	28,919	106,052
Bismuth ... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		(2 3)		(2 3)		(2 3)
Raw ... short tons	(2)	(2)	(2)	(2)		
Copper ... pounds	142,136,000	18,477,680	122,464,000	16,532,640	105,190,000	14,200,650
Diatomite ... short tons	(2)	(2)	(2)	(2)	(2)	(2)
Dumortierite ... do	(2)	(2)	(2)	(2)	(2)	(2)
Fluorspar ... do	8,653	(2)	7,293	(2)	7,038	(2)
Fuller's earth ... do	(2)	(2)	(2)	(2)	(2)	(2)
Gems and precious stones		(4)		(4)		(4)
Gold ... troy ounces	144,442	5,055,470	119,056	4,166,960	92,265	3,229,275
Graphite, amorphous ... short tons	(2)	(2)				
Gypsum (crude) ... do	347,961	702,906	392,748	693,107	368,246	732,253
Iron ore ... long tons	7,368	37,856	32,281	230,684	6,196	(2)
Lead ... short tons	4,790	718,500	6,605	1,056,800	6,275	1,079,300
Lime ... do	(2)	(2)	(2)	(2)	(2)	(2)
Magnesite ... do	(2)	(2)	(2)	(2)	(2)	(2)
Magnesium ... do	(2)	(2)	33,368	13,947,785	423	118,926
Magnesium oxide (hydrated) (brucite) ... do	(2)	(2)	(2)	(2)	(2)	(2)
Manganese ore ... do	10,451	220,126	21,799	900,010	960	(2)

Manganiferous ore ..... do	6,383	(2)	7,492	(2)	2,212	(2)
Marl, calcareous ..... do	(2)	(2)	(2)	(2)	(2)	(2)
Mercury ..... flasks (76 pounds)	4,577	893,476	2,460	291,166	4,338	585,153
Mica, sheet ..... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Mineral waters ..... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Molybdenum ..... pounds	(2)	(2)	(2)	(2)	(2)	(2)
Ores (crude), etc.:						
Copper ..... short tons	7,721,562	(5)	6,181,967	(5)	4,917,945	(5)
Dry and siliceous (gold and silver) ..... do	462,175	(5)	425,659	(5)	202,767	(5)
Lead ..... do	22,297	(5)	13,993	(5)	12,707	(5)
Zinc ..... do	156,845	(5)	225,019	(5)	94,029	(5)
Zinc-lead ..... do	1,164	(5)	16,867	(5)	147,225	(5)
Quartz crystal ..... pounds	(2)	(2)	(1)	(1)	.....	.....
Salt ..... short tons	30,291	53,009	(2)	(2)	(2)	(2)
Sand and gravel ..... do	1,741,011	929,347	983,074	713,302	999,781	914,476
Silver ..... troy ounces	1,620,280	1,152,199	1,259,636	895,741	1,043,380	741,959
Stone ..... short tons	107,390	165,483	90,590	138,954	104,180	151,673
Talc, pinite, and pyrophyllite ..... do	11,791	171,351	9,590	150,325	7,166	129,952
Tin (metallic equivalent) ..... do	4	4,480	.....	.....	.....	.....
Tungsten ore (60-percent concentrates) ..... do	2,910	4,647,905	2,665	3,902,893	2,038	2,923,430
Vanadium ..... pounds	32,934	33,305	.....	.....	.....	.....
Zinc ..... short tons	13,647	2,947,752	20,699	4,719,372	21,457	4,935,110
Miscellaneous [6]	.....	20,259,325	.....	3,368,809	.....	1,662,459
Total value, eliminating duplications	.....	56,525,000	.....	51,800,000	.....	31,517,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "2" above.

NEW HAMPSHIRE

Beryllium ore ..... short tons	42	$6,305	(1)	(1)	1	$357
Clay products (other than pottery and refractories)	.....	[2] 200,000	.....	(1,2)	.....	(1,2)
Feldspar (crude) ..... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones	.....	(3)	.....	(3)	.....	(3)
Mica:						
Scrap ..... short tons	1,148	28,643	2,339	$55,851	442	11,206
Sheet ..... pounds	700,543	583,543	323,636	617,172	532,944	144,947
Mineral waters ..... gallons sold	(3)	(3)	(3)	(3)	(3)	(3)
Peat ..... short tons	80	1,705	(1)	(1)	(1)	(1)
Sand and gravel ..... do	611,582	126,325	838,668	120,943	[4] 943,076	[4] 93,812
Scythestones ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ..... do	70,910	171,371	910	48,000	3,760	93,089
Miscellaneous [5]	.....	231,666	.....	323,774	.....	457,760
Total value, eliminating duplications	.....	1,350,000	.....	1,166,000	.....	801,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] No canvass.
[4] "Government-and-contractor." Value of "Commercial" included under "Miscellaneous."
[5] Includes minerals indicated by "1" and "4" above.

Mineral products of the United States, 1943–45, by States—Continued

NEW JERSEY

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Aluminum ... short tons	([1,2])	([1,2])	([1,2])	([1,2])	------	------
Clay:						
Products (other than pottery and refractories)	------	[3] $4,500,000	------	[3] $3,500,000	------	[3] $1,808,723
Raw ... short tons	[4] 153,569	[4] 705,956	[4] 98,903	[4] 600,331	[4] 252,664	[4] 794,564
Coke ... do	1,014,268	([1,2])	1,022,917	([1,2])	1,284,020	([1,2])
Ferro-alloys ... do	([1,2])	([1,2])	([1,2])	([1,2])	([1,2])	([1,2])
Iron ore ... long tons	521,795	3,584,229	498,799	3,455,213	428,747	2,956,510
Lime ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Magnesium oxide (magnesia) ... pounds	([1])	([1])	([1])	([1])	([1])	([1])
Manganiferous residuum ... short tons	270,328	([1])	247,402	([1])	224,331	([1])
Marl, greensand ... do	10,056	522,124	4,908	505,651	4,986	477,919
Mineral paints (zinc and lead pigments) ... do	([1,2])	([1,2])	([1,2])	([1,2])	([1,2])	([1,2])
Mineral waters ... gallons sold	([5])	([5])	([5])	([5])	([5])	([5])
Ore (zinc) ... short tons	602,646	([6])	543,007	([6])	522,177	([6])
Peat ... do	11,060	66,813	13,304	83,150	([1])	([1])
Sand and gravel ... do	[7] 5,020,373	[7] 5,217,688	[7] 4,514,374	[7] 5,081,861	4,506,379	4,652,938
Sand and sandstone (ground) ... do	([1])	([1])	([1])	([1])	([1])	([1])
Silica (quartz) ... do	([1])	([1])	([1])	([1])	([1])	([1])
Stone ... do	2,611,440	3,584,645	2,211,690	3,321,978	[8] 2,261,750	[8] 3,498,182
Zinc [9] ... do	92,864	16. 249,518	80,288	14,080,644	81,392	14,299,032
Miscellaneous [10]	------	18,600,318	------	15,521,134	------	14,482,834
Total value, eliminating duplications	------	37,583,000	------	33,794,000	------	31,253,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metal.
[7] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[8] Exclusive of dimension basalt, value for which is included under "Miscellaneous."
[9] Value reported for zinc in New Jersey is estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[10] Includes minerals indicated by "1," "7," and "8" above.

NEW MEXICO

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Arsenious oxide ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Beryllium ore ... do	([2])	([2])	29	$3,789	------	------
Bismuth ... pounds	([1])	([1])	([1])	([1])	([1])	([1])
Clay:						
Products (other than pottery and refractories)	------	[3] $120,000	------	([2,3])	------	([2,3])
Raw ... short tons	[4] 5,772	[4] 16,908	[4] 5,622	[4] 19,933	[4] 22,200	[4] $30,720
Coal ... do	1,850,827	6,528,826	1,743,674	6,604,398	1,500,000	5,932,000
Copper ... pounds	152,326,000	19,802,380	139,460,000	18,827,100	113,142,000	15,274,170

Diatomite	short tons	(2)	(2)	----	----	----	----
Fluorspar	do	37,050	986,094	42,973	1,205,830	14,449	390,331
Gems and precious stones		----	(5)	----	(5)	----	(5)
Gold	troy ounces	5,563	194,705	6,918	242,130	5,604	196,140
Helium	cubic feet	----	----	[6] 2,243,414	[6] 14,066	----	----
Iron ore	long tons	41,744	104,076	33,460	(2)	369	(2)
Lead	short tons	5,723	858,450	7,265	1,162,400	7,662	1,317,864
Lime	do	(2)	(2)	(2)	(2)	(2)	(2)
Lithium minerals	do	41	2,038	----	----	----	----
Magnesium chloride (natural)	pounds	(2)	(2)	(2)	(2)	----	----
Manganese ore	short tons	469	13,832	273	7,155	3,334	(2)
Manganiferous ore	do	72,967	(2)	100,683	(2)	85,744	(2)
Mica:							
Scrap	do	393	6,711	816	14,574	491	9,082
Sheet	pounds	6,699	19,834	3,347	8,893	(2)	(2)
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Molybdenum	pounds	(2)	(2)	(2)	(2)	(2)	(2)
Natural gas	M cubic feet	86,500,000	13,926,000	87,727,000	13,980,000	95,000,000	14,290,000
Natural gasoline and allied products:							
Natural gasoline	gallons	73,126,000	3,302,000	69,528,000	3,345,000	87,098,000	3,940,000
Liquefied petroleum gases	do	7,879,000	187,000	11,633,000	326,000	10,701,000	320,000
Ores (crude), etc.:							
Copper	short tons	7,571,937	(7)	7,207,554	(7)	6,228,727	(7)
Dry and siliceous (gold and silver)	do	2,916	(7)	2,265	(7)	14,483	(7)
Lead	do	586	(7)	4,277	(7)	4,627	(7)
Lead-copper	do	60	(7)	----	----	----	----
Zinc	do	361,391	(7)	6,332	(7)	265,931	(7)
Zinc-lead	do	392,153	(7)	723,418	(7)	329,559	(7)
Petroleum	barrels	38,896,000	38,900,000	39,555,000	39,600,000	37,281,000	37,520,000
Potassium salts	short tons	[8] 604,414	21,918,503	[8] 679,721	24,739,507	[8] 733,176	25,456,731
Pumice	do	4,837	202,558	(2)	(2)	(2)	(2)
Salt	do	10,829	21,427	23,759	105,860	9,980	20,694
Sand and gravel	do	[9] 230,458	[9] 147,624	439,286	292,601	[9] 448,438	[9] 317,968
Silver	troy ounces	463,583	329,659	535,275	380,640	465,127	330,757
Stone	short tons	[10] 421,590	[10] 228,432	[10] 609,240	[10] 334,357	361,700	173,120
Talc	do	(2)	(2)	(2)	(2)	(2)	(2)
Tantalum and columbium ores	pounds	7,866	24,370	(2)	(2)	(2)	(2)
Tin (metallic equivalent)	short tons	1	790	(2)	(2)	----	----
Tungsten ore (60-percent concentrates)	do	----	----	9	(2)	----	----
Vanadium	pounds	(2)	(2)	(2)	(2)	----	----
Zinc	short tons	59,524	12,857,184	50,727	11,565,756	40,295	9,267,850
Miscellaneous [11]		----	3,105,947	----	2,046,610	----	1,732,895
Total value, eliminating duplications		----	123,805,000	----	124,827,000	----	116,508,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Figures cover fiscal year ended June 30 of year stated.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Equivalent as K_2O.
[9] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[10] Exclusive of granite in 1943 and of sandstone in 1944, value for which is included under "Miscellaneous."
[11] Includes minerals indicated by "2," "9," and "10" above.

Mineral products of the United States, 1943–45, by States—Continued

NEW YORK

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Aluminum ... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Cement ... barrels	[3] 5,914,660	[3] $8,765,665	[3] 4,411,695	[3] $6,839,676	[3] 5,578,906	[3] $9,009,454
Clay:						
Products (other than pottery and refractories)		[4] 3,000,000		[4] 1,500,000		[4] 2,376,670
Raw ... short tons	(1)	(1)	(1)	(1)	[5] 320,683	[5] 272,302
Coke ... do	5,347,369	[2] 39,091,561	6,102,560	[2] 47,155,591	5,789,974	[2] 46,676,238
Diatomite ... do	(1)	(1)	(1)	(1)	(1)	(1)
Emery ... do	6,666	63,195	6,940	64,858	7,856	75,977
Feldspar (crude) ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys ... short tons	399,070	[2] 60,578,749	324,302	[2] 55,670,642	286,895	[2] 48,245,824
Garnet, abrasive ... do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		(6)		(6)		(6)
Graphite, artificial ... pounds	(1 2)	(1 2)	(1 2)	(1 2)		
Gypsum (crude) ... short tons	713,961	1,229,796	594,067	1,128,821	557,902	1,262,989
Iron:						
Ore ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Pig ... short tons	3,953,462	[2] 79,873,775	3,836,078	[2] 76,575,005	3,278,345	[2] 74,857,092
Lead ... do	2,355	353,250	1,644	263,040	862	148,264
Lime ... do	121,890	976,692	193,395	1,410,956	(1)	(1)
Magnesium ... do	(1)	(1)	1,380	565,800		
Marl, calcareous ... do	(1)	(1)				
Millstones		(1)		(1)		3,577
Mineral waters ... gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Natural gas ... M cubic feet	8,062,000	5,994,000	7,052,000	5,164,000	6,000,000	4,395,000
Natural gasoline ... gallons	12,000	1,000	12,000	1,000	5,000	(1)
Ores (crude), etc.:						
Zinc ... short tons	154,001	(7)	120,106	(7)	97,040	(7)
Zinc-lead ... do	359,944	(7)	303,451	(7)	228,062	(7)
Peat ... do	(1)	(1)	(1)	(1)	(1)	(1)
Petroleum ... barrels	5,059,000	15,230,000	4,697,000	15,640,000	4,648,000	17,470,000
Pyrites ... long tons	62,907	227,723	(1)	(1)	(1)	(1)
Salt ... short tons	2,926,388	9,328,672	2,925,675	9,899,580	2,862,224	10,327,013
Sand and gravel ... do	[8] 7,375,378	[8] 5,256,547	7,049,583	4,308,390	7,477,628	5,049,905
Silver ... troy ounces	38,004	27,025	25,238	17,947	14,271	10,148
Slate		613,566		791,093		(1)

Stone .... short tons	8,660,970	8,917,164	7,454,160	8,073,778	7,900,560	9,133,781
Talc .... do	136,291	2,003,080	(1)	(1)	(1)	(1)
Titanium concentrates: Ilmenite .... do	165,198	(1)	216,258	(1)	240,090	(1)
Wollastonite .... do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc .... do	46,000	9,936,000	35,541	8,103,348	24,978	5,744,940
Miscellaneous [9]	....	86,108,295	....	64,905,474	....	46,152,554
Total value, eliminating duplications	....	88,416,000	....	87,632,000	....	90,286,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Exclusive of natural cement, value for which is included under "Miscellaneous."
[4] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[5] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[9] Includes minerals indicated by "1," "3," and "8" above.

NORTH CAROLINA

Aluminum .... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Asbestos .... do	(1)	(1)	(1)	(1)	(1)	(1)
Barite .... do	....	....	(1)	(1)	(1)	(1)
Beryllium ore .... do	(1)	(1)	(1)	(1)	....	....
Bromine .... pounds	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	....	[3] $3,000,000	....	[3] $2,700,000	....	[3] $3,471,219
Raw .... short tons	(1)	(1)	[4] 25,663	[4] 428,821	[4] 525,506	[4] 783,220
Copper .... pounds	(1)	(1)	(1)	(1)	....	....
Feldspar (crude) .... long tons	112,144	656,182	122,857	778,007	148,493	863,740
Flint lining for tube mills .... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Garnet, abrasive .... do	(1)	(1)	....	....	....	....
Gems and precious stones	....	(5)	....	(5)	....	(5)
Gold .... troy ounces	131	4,585	21	735	....	....
Kyanite .... short tons	(1)	(1)	....	....	....	....
Lime .... do	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals .... do	(1)	(1)	(1)	(1)	(1)	(1)
Manganese ore .... do	140	(1)	....	....	....	....
Manganiferous ore .... do	115	(1)	....	....	....	....
Mica:						
Scrap .... do	25,295	516,367	29,774	750,285	22,502	406,612
Sheet .... pounds	1,901,120	1,772,324	814,874	1,530,625	563,990	243,058
Millstones	....	(1)	....	(1)	....	(1)
Mineral waters .... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Olivine .... short tons	5,415	48,633	3,270	35,207	(1)	(1)
Ores (crude): Copper .... do	24,332	(6)	6,438	(6)	....	....
Pebbles for grinding .... do	(1)	(1)	(1)	(1)	3,644	116,300
Quartz crystal .... pounds	(1)	(1)	(7)	(7)	....	....

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

NORTH CAROLINA—Continued

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Sand and gravel short tons	3,046,168	$1,823,516	2,535,601	$1,405,917	2,394,089	$1,517,203
Sand and sandstone (ground) do	(1)	(1)	(1)	(1)		
Silica (quartz) do	(1)	(1)	(1)	(1)	(1)	(1)
Silver troy ounces	7,169	5,098	1,461	1,039		
Stone short tons	4,871,260	5,376,600	4,659,540	5,975,951	[8] 2,297,670	[8] 2,965,458
Talc, pyrophyllite, and ground soapstone do	65,698	580,106	69,892	645,156	77,529	675,789
Tantalum and columbium ores: Columbium ore pounds	4,219	1,055	(1)	(1)	(1)	(1)
Tin (metallic equivalent) do			100	50		
Titanium concentrates: Ilmenite short tons	(1)	(1)	16,333	(1)	17,216	(1)
Tungsten ore (60-percent concentrates) do	40	(1)	186	(1)	132	(1)
Vermiculite do	(1)	(1)	(1)	(1)	(1)	(1)
Miscellaneous [9]		23,897,592		17,221,581		12,668,510
Total value, eliminating duplications		22,172,000		22,199,000		14,457,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Figures not available.
[8] Exclusive of marble and sandstone, value for which is included under "Miscellaneous."
[9] Includes minerals indicated by "1" and "8" above.

NORTH DAKOTA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Clay:						
Products (other than pottery and refractories)		(1 2)		(1 2)		(1 2)
Raw short tons	(1)	(1)	(1)	(1)	[3] 6,026	[3] $4,450
Coal do	2,500,202	$3,752,000	2,306,092	$3,535,000	2,488,000	3,906,000
Mineral waters gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas M cubic feet	177,000	60,000	200,000	65,000	217,000	71,000
Sand and gravel short tons	1,459,232	550,263	2,127,029	733,340	1,769,086	523,163
Miscellaneous [5]		60,024		60,024		50,514
Total value, eliminating duplications		4,422,000		4,393,000		4,551,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Includes minerals indicated by "1" above.

OHIO

Bromine pounds	46,264	$9,042	13,404	$2,653		
Calcium chloride short tons	224	1,239	1,253	7,092		
Cement barrels	6,096,187	8,798,964	4,129,017	5,957,819	4,833,183	$7,356,271
Clay:						
Products (other than pottery and refractories)		[1] 15,000,000		[1] 12,000,000		[1] 18,609,369
Raw short tons	[2] 793,668	[2] 1,615,431	[2] 642,786	[2] 1,340,809	[2] 2,385,764	[2] 4,048,315
Coal do	32,254,993	78,009,123	33,877,055	89,699,797	32,715,000	92,911,000
Coke do	10,270,758	[3] 64,405,750	10,338,913	[3] 70,781,105	9,405,710	[3] 70,381,885
Ferro-alloys do	201,812	[3] 12,738,206	232,831	[3] 14,426,924	189,619	[3] 11,166,247
Grindstones do	10,388	381,959	([4])	([4])	9,534	385,140
Gypsum (crude) do	([4])	([4])	([4])	([4])	([4])	([4])
Iron, pig do	13,750,856	[3] 299,483,340	13,400,053	[3] 294,265,267	11,264,024	[3] 258,959,815
Lime do	1,469,654	12,001,684	1,467,575	11,876,409	1,420,983	11,693,615
Magnesium do	([4])	([4])	([4])	([4])	([4])	([4])
Mineral paints (zinc and lead pigments) do	([3,4])	([3,4])	([3,4])	([3,4])	([3,4])	([3,4])
Mineral waters gallons sold	([5])	([5])	([5])	([5])	([5])	([5])
Natural gas M cubic feet	52,001,000	27,255,000	51,724,000	26,783,000	47,000,000	24,490,000
Natural gasoline gallons	6,495,000	362,000	7,282,000	440,000	6,496,000	378,000
Peat short tons	739	6,298	683	5,889	1,115	11,429
Petroleum barrels	3,322,000	6,810,000	2,937,000	6,560,000	2,828,000	7,240,000
Salt short tons	2,818,928	3,824,508	2,891,395	4,076,481	2,764,926	3,997,759
Sand and gravel do	12,569,930	10,003,339	10,327,012	8,866,549	9,420,380	7,985,018
Sand and sandstone (ground) do	([4])	([4])	([4])	([4])	([4])	([4])
Scythestones, whetstones, etc do	([4])	([4])	([4])	([4])	347	24,256
Stone do	15,909,740	15,598,542	[6] 15,048,230	[6] 15,292,705	[6] 13,279,800	[6] 13,966,710
Sulfuric acid (60° B.) [7] do	([3,4])	([3,4])	([3,4])	([3,4])	([3,4])	([3,4])
Miscellaneous [8]		12,492,174		11,827,485		7,446,925
Total value, eliminating duplications		189,422,000		192,052,000		196,633,000

[1] 1943-44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[2] 1943-44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

[3] Value not included in total value for State.

[4] Value included under "Miscellaneous."

[5] No canvass.

[6] Exclusive of unclassified stone, value for which is included under "Miscellaneous."

[7] From zinc-roasting operation.

[8] Includes minerals indicated by "4" and "6" above.

Mineral products of the United States, 1943–45, by States—Continued

OKLAHOMA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Asphalt (native) short tons	(1)	(1)	(1)	(1)	(1)	(1)
Cement barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $700,000		[2] $600,000		[2] $707,272
Raw short tons	(1)	(1)	(1)	(1)	[3] 243,358	[3] 178,658
Coal do	2,837,347	8,954,354	3,208,534	11,135,485	2,897,000	9,965,000
Gypsum (crude) do	(1)	(1)	(1)	(1)	(1)	(1)
Lead do	19,733	2,959,950	13,944	2,231,040	12,664	2,178,208
Lime do	(4)	(1)	(1)	(1)	(1)	(1)
Manganese ore do	265	(1)				
Mineral waters gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas M cubic feet	285,045,000	42,503,000	310,888,000	46,346,000	345,000,000	52,580,000
Natural gasoline and allied products:						
Natural gasoline gallons	309,942,000	15,663,000	301,246,000	17,200,000	280,625,000	15,200,000
Liquefied petroleum gases do	112,371,000	2,858,000	120,522,000	3,400,000	136,224,000	4,100,000
Ores (crude), etc.:						
Lead short tons	4	(5)	14	(5)	6	(5)
Zinc do	9,785,962	(5)	9,908,605	(5)	9,545,153	(5)
Zinc-lead do	3,874,225	(5)	3,703,111	(5)	2,640,147	(5)
Petroleum barrels	128,152,000	146,550,000	124,616,000	153,290,000	138,036,000	176,500,000
Pumice short tons	(1)	(1)				
Salt do	7,716	30,496	(1)	(1)	(1)	(1)
Sand and gravel do	2,141,705	1,191,929	1,364,604	746,207	1,274,186	761,448
Stone do	6,169,750	3,205,329	4,563,270	1,799,765	3,894,720	1,572,772
Sulfuric acid (60° B.) [6] do	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)	(1 7)
Tripoli do	(1)	(1)				
Zinc do	114,085	24,642,360	91,449	20,850,372	69,300	15,939,000
Miscellaneous [8]		5,867,180		3,606,355		3,716,517
Total value, eliminating duplications		254,642,000		260,832,000		282,859,000

[1] Value included under "Miscellaneous."

[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.

[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.

[4] No canvass.

[5] Not valued as ore; value of recoverable metal content included under the metals.

[6] From zinc smelting.

[7] Value not included in total value for State.

[8] Includes minerals indicated by "1" above.

OREGON

Aluminum ... short tons	([1 2])	([1 2])	([1 2])	([1 2])	([1 2])	([1 2])
Antimony ore (concentrates) ... do	632	$12,170	1,202	$16,089	436	$9,894
Arsenious oxide ... do	([3])	([3])	([3])	([3])		
Asbestos ... do	([1])	([1])	([1])	([1])		
Cement ... barrels	([1])	([1])	([1])	([1])	([1])	([1])
Chromite ... short tons	16,363	374,119	7,818	312,096	4,366	167,667
Clay:						
Products (other than pottery and refractories)		[4] 500,000		[4] 400,000		[4] 463,647
Raw ... short tons	([1])	([1])	([1])	([1])	[5] 128,484	[5] 93,357
Coal ... do	1,200	4,800	1,453	8,718		
Copper ... pounds	12,000	1,560	6,000	810	2,000	270
Diatomite ... short tons	([1])	([1])	([1])	([1])	([1])	([1])
Ferro-alloys ... do	([1 2])	([1 2])	([1 2])	([1 2])	([1 2])	([1 2])
Gems and precious stones		([6])		([6])		([6])
Gold ... troy ounces	1,097	38,395	1,369	47,915	4,467	156,345
Lead ... short tons	4	600	4	640	1	172
Lime ... do	([1])	([1])	([1])	([1])	([1])	([1])
Manganese ore ... do	143	([1])				
Mercury ... flasks (76 pounds)	4,651	907,922	3,159	373,899	2,500	337,225
Mineral waters ... gallons sold	([6])	([6])	([6])	([6])	([6])	([6])
Ores (crude), etc.:						
Copper ... short tons	34	([7])				
Dry and siliceous (gold and silver) ... do	2,646	([7])	4,217	([7])	1,378	([7])
Platinum metals (crude) ... troy ounces					3	([1])
Pumice ... short tons			([1])	([1])	([1])	([1])
Sand and gravel ... do	[8] 4,013,846	[8] 3,473,708	4,601,163	3,752,671	4,476,504	3,681,256
Silica (quartz) ... do			([1])	([1])	1,462	16,260
Silver ... troy ounces	10,523	7,483	20,243	14,395	10,461	7,439
Stone ... short tons	1,535,490	1,834,271	1,947,230	2,378,142	[9] 1,498,160	[9] 1,898,073
Zinc ... do					1	230
Miscellaneous [10]		19,258,020		17,756,962		11,230,845
Total value, eliminating duplications		12,267,000		9,657,000		9,398,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures not available.
[4] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[5] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[9] Exclusive of sandstone and unclassified stone, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1," "8," and "9" above.

Mineral products of the United States, 1943–45, by States—Continued

PENNSYLVANIA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Cement ... barrels	[1] 19,551,388	[1] $27,907,236	[1] 13,918,172	[1] $20,689,765	16,232,722	$25,549,621
Clay:						
Products (other than pottery and refractories)		[2] 7,000,000		[2] 6,000,000		[2] 8,233,763
Raw ... short tons	[3] 1,250,735	[3] 3,227,363	[3] 989,035	[3] 2,712,458	[3] 2,191,536	[3] 5,347,951
Coal:						
Anthracite ... do	60,643,620	306,816,018	63,701,363	354,582,884	54,933,909	323,944,435
Bituminous ... do	141,049,814	397,634,020	146,052,415	459,508,954	131,650,000	433,627,000
Cobalt ... pounds	763,772	(4)	(4)	(4)	(4)	(4)
Coke ... short tons	23,453,317	[5] 135,887,231	23,147,471	[5] 144,654,808	19,838,857	[5] 131,395,424
Copper [6] ... pounds	(4)	(4)	(4)	(4)	(4)	(4)
Feldspar (crude) ... long tons	(4)	(4)	(4)	(4)	(4)	(4)
Ferro-alloys ... short tons	662,296	[5] 117,243,191	692,781	[5] 110,626,554	594,888	[5] 88,579,690
Gems and precious stones		(7)		(7)		(7)
Gold [6] ... troy ounces	2,218	77,630	2,115	74,025	1,588	55,580
Graphite, crystalline ... pounds	(4)	(4)				
Iron:						
Ore ... long tons	(4)	(4)	(4)	(4)	(4)	(4)
Pig ... short tons	18,593,220	[5] 399,568,279	18,503,427	[5] 397,395,665	16,168,496	[5] 361,684,919
Lime ... do	1,021,215	7,864,323	1,026,292	7,933,361	903,914	7,221,808
Mica:						
Scrap ... do			(4)	(4)	286	1,430
Sheet ... pounds	4	22				
Mineral paints (zinc and lead pigments) ... short tons	(4 5)	(4 5)	(4 5)	(4 5)	(4 5)	(4 5)
Mineral waters ... gallons sold	(7)	(7)	(7)	(7)	(7)	(7)
Natural gas ... M cubic feet	93,543,000	45,272,000	92,987,000	45,542,000	82,000,000	40,270,000
Natural gasoline and allied products:						
Natural gasoline ... gallons	17,084,000	893,000	17,023,000	990,000	13,718,000	770,000
Liquefied petroleum gases ... do	450,000	40,000	472,000	42,000	573,000	50,000
Peat ... short tons	5,790	14,925	6,750	20,894	(4)	(4)
Petroleum ... barrels	15,757,000	46,960,000	14,118,000	46,400,000	12,515,000	46,680,000
Pyrites ... long tons	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel ... short tons	9,279,469	9,251,344	6,919,406	7,265,943	6,768,944	7,247,613
Sand and sandstone (ground) ... do	(4)	(4)	(4)	(4)	(4)	(4)
Silver [6] ... troy ounces	13,095	9,312	13,545	9,632	10,434	7,420
Slate		1,836,925		1,827,896		1,929,741
Soapstone ... short tons	(4)	(4)	(4)	(4)	(4)	(4)
Stone ... do	[8] 19,999,570	[8] 23,566,298	[8] 18,175,280	[8] 22,516,282	[8] 17,708,390	[8] 22,266,706
Sulfuric acid (60° B.) [9] ... do	357,992	[5] 3,536,961	353,094	[5] 3,509,754	346,387	[5] 3,498,509

Tripoli (rottenstone)......do....	(4)	(4)	(4)	(4)	561	8,452
Miscellaneous [10]		26,316,308		24,626,924		22,181,938
Total value, eliminating duplications		889,077,000		985,464,000		930,113,000

[1] Exclusive of natural cement, value for which is included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value included under "Miscellaneous."
[5] Value not included in total value for State.
[6] Copper, gold, and silver were recovered from magnetite-pyrite-chalcopyrite ore, which is included as iron ore produced. Bureau of Mines not at liberty to publish figures.
[7] No canvass.
[8] Exclusive of dimension basalt in 1943 and of crushed granite in 1944 and 1945, value for which is included under "Miscellaneous."
[9] From zinc smelting.
[10] Includes minerals indicated by "1," "4," and "8" above.

RHODE ISLAND

Clay products (other than pottery and refractories)		(1 2)				
Coke......short tons..	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Graphite, amorphous......do....	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters......gallons sold..	(4)	(4)	(4)	(4)	(4)	(4)
Sand and gravel......short tons..	356,043	$327,750	352,905	$287,112	317,300	$221,530
Stone......do....	171,230	410,478	[5] 19,790	[5] 213,351	[5] 11,280	[5] 219,263
Miscellaneous [6]		2,582,906		2,684,814		2,554,887
Total value, eliminating duplications		808,000		612,000		508,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Exclusive of basalt and unclassified stone in 1944 and of unclassified stone in 1945, value for which is included under "Miscellaneous."
[6] Includes minerals indicated by "1" and "5" above.

SOUTH CAROLINA

Barite......short tons..	(1)	(1)	(1)	(1)		
Clay:						
Products (other than pottery and refractories)		[2] $1,200,000		[2] $1,100,000		[2] $1,286,592
Raw......short tons..	[3] 116,458	[3] 965,153	[3] 140,883	[3] 1,111,884	[3] 380,769	[3] 1,659,268
Copper......pounds..	1,000	130				
Corundum......short tons..	(1)	(1)	(1)	(1)		
Ferro-alloys......do....	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Gems and precious stones		(5)		(5)		(5)
Gold......troy ounces..	147	5,145				
Manganese ore......short tons..	312	(1)	1,484	(1)	41	(1)
Manganiferous ore......do....	155	(1)	171	(1)		
Mica:						
Scrap......do....	5	100				
Sheet......pounds..	573	1,067			275	889

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

SOUTH CAROLINA—Continued

Product		1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Mineral waters	gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Ore (dry and siliceous) (gold and silver)	short tons	156	(6)				
Sand and gravel	do	452,166	$217,280	269,743	$190,114	319,933	$202,335
Silver	troy ounces	135	96				
Stone	short tons	[7] 1,615,730	[7] 1,804,196	1,195,900	1,717,295	[7] 1,380,800	[7] 2,041,202
Topaz, industrial	do	(1)	(1)	(1)	(1)	(1)	(1)
Vermiculite	do	(1)	(1)	(1)	(1)	(1)	(1)
Miscellaneous [8]			4,641,855		2,736,985		2,314,077
Total value, eliminating duplications			4,759,000		4,192,000		5,043,000

1 Value included under "Miscellaneous."
2 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
3 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
4 Value not included in total value for State.
5 No canvass.
6 Not valued as ore; value of recoverable metal content included under the metals.
7 Exclusive of dimension granite in 1943 and of unclassified stone in 1945, value for which is included under "Miscellaneous."
8 Includes minerals indicated by "1" and "7" above.

SOUTH DAKOTA

Product		1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Beryllium ore	short tons	238	$28,843	306	$44,565	38	$5,776
Cement	barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:							
Products (other than pottery and refractories)			(1 2)		(1 2)		(1 2)
Raw	short tons	[3] 124,528	[3] 822,264	[3] 169,893	[3] 1,104,919	[3] 194,929	[3] 1,214,132
Coal	do	40,664	78,000	26,827	55,000	35,000	79,000
Copper	pounds			2,000	270		
Feldspar (crude)	long tons	70,913	342,643	64,806	288,188	68,374	314,787
Gems and precious stones			(4)		(4)		(4)
Gold	troy ounces	106,444	3,725,540	11,621	406,735	55,948	1,958,180
Gypsum (crude)	short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore sold for paint	long tons	1,678	(1)	1,038	(1)	4,162	(1)
Lead	short tons	41	6,150	34	5,440		
Lime	do	(1)	(1)	(1)	(1)	(1)	(1)
Lithium minerals	do	5,452	200,194	4,416	172,421	225	8,370
Manganese ore	do	12	(1)				
Mica:							
Scrap	do	2,234	42,764	2,558	51,405	1,192	21,534
Sheet	pounds	333,424	447,209	146,383	472,026	56,570	178,696
Mineral waters	gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas	M cubic feet	6,000	2,000	5,000	2,000	5,000	2,000

Ores (crude), etc.:						
Dry and siliceous (gold and silver) short tons	202,018	(5)			312,612	(5)
Zinc-lead do	2,914	(5)	2,839	(5)		
Sand and gravel do	2,291,450	701,034	2,501,431	956,178	2,642,494	1,106,983
Silica (quartz) do					(1)	(1)
Silver troy ounces	35,886	25,519	5,445	3,872	26,564	18,890
Stone short tons	[6] 269,410	[6] 1,304,370	255,530	1,412,141	[6] 303,500	[6] 1,605,904
Tantalum and columbium ores pounds	872	1,354	(1)	(1)	(1)	(1)
Tin (metallic equivalent) short tons	1	750	(1)	(1)		
Tungsten ore (60-percent concentrates) do			7	(1)	4	(1)
Zinc do	46	9,936	56	12,768		
Miscellaneous [7]		869,434		484,534		662,163
Total value, eliminating duplications		8,608,000		5,472,000		7,165,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Exclusive of unclassified stone in 1943 and of crushed granite and unclassified stone in 1945, value for which is included under "Miscellaneous."
[7] Includes minerals indicated by "1" and "6" above.

TENNESSEE

Aluminum short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Barite do	52,593	$383,007	43,033	$279,567	32,812	$256,756
Cement barrels	4,579,526	7,342,894	3,811,780	6,080,921	2,898,053	4,669,330
Clay:						
Products (other than pottery and refractories)		[3] 1,800,000		[3] 1,500,000		[3] 1,988,736
Raw short tons	[4] 167,374	[4] 759,806	[4] 141,417	[4] 764,016	[4] 482,107	[4] 1,196,498
Coal do	7,178,918	20,321,025	7,266,047	23,704,464	6,600,000	23,001,000
Coke do	303,072	(1 2)	228,353	(1 2)	236,979	(1 2)
Copper pounds	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys short tons	114,541	[2] 11,934,337	69,451	(1 2)	60,646	(1 2)
Fluorspar do	57	1,650				
Fuller's earth do	(1)	(1)	(1)	(1)	(1)	(1)
Gold troy ounces	303	10,605	222	7,770	148	5,180
Iron:						
Ore (sinter from copper-iron ore) long tons	(1)	(1)	300,565	(1)	307,500	(1)
Pig short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Lead do	200	30,000			54	9,288
Lime do	235,854	1,503,850	193,202	1,246,802	207,587	1,373,268
Manganese ore do	2,605	(1)	418	(1)		
Manganiferous ore do	803	3,983	6,779	(1)	1,000	(1)
Mineral waters gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas M cubic feet	10,000	6,000	10,000	5,000	10,000	5,000
Ores (crude), etc.:						
Copper short tons	1,019,080	(5)	1,032,525	(5)	1,013,740	(5)
Lead do	2,666	(5)			575	(5)
Zinc do	1,486,365	(5)	1,575,031	(5)	1,322,799	(5)
Zinc-lead do	17,674	(5)				
Petroleum barrels	10,000	10,000	9,000	(1)	8,000	(1)
Phosphate rock long tons	(1)	(1)	1,321,664	5,953,933	1,289,231	6,027,987

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

TENNESSEE—Continued

Product	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Pyrites ..... long tons	[1]	[1]	[1]	[1]	[1]	[1]
Sand and gravel ..... short tons	2,922,752	$2,285,339	2,784,157	$2,314,478	3,097,626	$2,578,379
Silica (quartz) ..... do	[1]	[1]	[1]	[1]		
Silver ..... troy ounces	52,058	37,019	45,907	32,645	35,391	25,167
Stone ..... short tons	8,280,320	10,047,944	[7] 6,063,420	[7] 7,776,775	4,772,720	6,318,915
Strontium minerals ..... do	[1]	[1]				
Sulfuric acid (60° B.) [8] ..... do	[1 2]	[1 2]	[1 2]	[1 2]	[1 2]	[1 2]
Zinc ..... do	41,766	9,021,456	40,831	9,309,468	33,824	7,779,520
Miscellaneous [9]		64,836,623		54,324,215		46,155,760
Total value, eliminating duplications		64,485,000		63,998,000		60,199,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of crushed sandstone, value for which is included under "Miscellaneous."
[8] From copper smelting.
[9] Includes minerals indicated by "1" and "7" above.

TEXAS

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Asphalt (native) ..... short tons	[1]	[1]	[1]	[1]	[1]	[1]
Bromine ..... pounds	[1]	[1]	[1]	[1]	[1]	[1]
Cement ..... barrels	9,177,392	$15,635,708	6,261,931	$11,138,156	8,388,159	$14,790,545
Chromite ..... short tons	2	62				
Clay:						
Products (other than pottery and refractories)		[2] 3,000,000		[2] 3,200,000		[2] 4,985,138
Raw ..... short tons	[3] 182,407	[3] 486,177	[3] 147,599	[3] 617,507	[3] 846,000	[3] 1,443,704
Coal:						
Bituminous ..... do	9,097	39,300			108,000	90,000
Lignite ..... do	144,144	127,000	109,532	95,000		
Coke ..... do			184,506	[1 4]	140,254	[1 4]
Copper ..... pounds	162,000	21,060	230,000	31,050	110,000	14,850
Feldspar (crude) ..... long tons	[1]	[1]	[1]	[1]	[1]	[1]
Fluorspar ..... short tons	960	19,281	4,769	100,381	3,413	[1]
Fuller's earth ..... do	94,137	728,141	111,212	916,159	103,076	931,878
Gems and precious stones		[5]		[5]		[5]
Gold ..... troy ounces	4	140				

Graphite, crystalline....pounds	(1)	(1)	3,200,000	185,264	(1)	(1)
Gypsum (crude)....short tons	394,841	519,541	344,936	489,638	407,640	511,869
Helium....cubic feet	[6] 58,951,160	[6] 321,213	[6] 96,884,410	[6] 619,345	[6] 69,808,454	[6] 460,015
Iron:						
Ore....long tons	7,334	(1)	278,034	(1)	217,237	705,736
Pig....short tons	----	----	137,566	(1 4)	147,247	(1 4)
Lead....do	13	1,950	----	----	----	----
Lime....do	132,167	1,034,355	94,923	757,141	105,277	807,332
Magnesite....do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium....do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium compounds (natural)....pounds	647,496,000	10,778,617	444,738,000	7,123,721	171,936,000	2,818,408
Mercury....flasks (76 pounds)	1,769	345,326	1,095	129,604	(1)	(1)
Mica:						
Scrap....short tons	42	770	----	----	----	----
Sheet....pounds	31	157	----	----	----	----
Mineral waters....gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natural gas....M cubic feet	1,323,885,000	199,659,000	1,525,515,000	223,800,000	1,680,000,000	250,300,000
Natural gasoline and allied products:						
Natural gasoline and cycle products....gallons	1,221,736,000	52,775,000	1,324,877,000	64,099,000	1,439,069,000	66,590,000
Liquefied petroleum gases....do	424,295,000	10,387,000	544,618,000	14,765,000	719,931,000	20,740,000
Ores (crude), etc.:						
Copper....short tons	339	(7)	3,799	(7)	1,600	(7)
Dry and siliceous (gold and silver)....do	3,640	(7)	361	(7)	1,093	(7)
Lead....do	155	(7)	----	----	----	----
Peat....do	(1)	(1)	(1)	(1)	(1)	(1)
Pebbles for grinding....do	5,341	61,799	(1)	(1)	(1)	(1)
Petroleum....barrels	594,343,000	717,600,000	746,699,000	902,660,000	755,533,000	915,530,000
Pumice....short tons	(1)	(1)	(1)	(1)	584	11,680
Salt (sodium chloride)....do	1,127,854	3,610,532	1,147,397	3,627,528	1,100,791	3,490,820
Sand and gravel....do	12,679,989	8,523,820	9,307,531	6,424,132	11,038,244	7,595,904
Silver....troy ounces	10,284	7,313	5,355	3,808	23,265	16,544
Soapstone....short tons	----	----	(1)	(1)	(1)	(1)
Sodium sulfate (natural)....do	(1)	(1)	(1)	(1)	(1)	(1)
Stone....do	2,698,220	2,534,271	[8] 2,742,120	[8] 2,455,791	2,798,580	2,726,659
Strontium minerals....do	4,958	62,137	(1)	(1)	(1)	(1)
Sulfur....long tons	2,385,909	38,174,544	2,874,478	45,991,648	3,069,815	49,117,040
Sulfuric acid (60° B.)[9]....short tons	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Sulfur ore....long tons	2,500	25,000	1,550	7,750	1,300	6,500
Vermiculite....short tons	199	1,990	----	----	----	----
Miscellaneous [10]	----	37,456,411	----	37,000,083	----	22,443,004
Total value, eliminating duplications	----	1,103,390,000	----	1,321,541,000	----	1,360,694,000

[1] **Value included** under "Miscellaneous."
[2] **1943–44:** Estimate by Bureau of Mines based on figures issued by Bureau of the Census **covering certain** classes of clay products; 1945: Figures obtained through cooperation **with Bureau** of the Census.
[3] **1943–44:** Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy **clay products** not included in total value for State.
[4] **Value** not included in total value for State.
[5] No canvass.
[6] Figures cover fiscal year ended June 30 of year stated.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of basalt and dimension unclassified stone, value for which is included under "Miscellaneous."
[9] From zinc smelting.
[10] Includes minerals indicated by "1" and "8" above.

Mineral products of the United States, 1943–45, by States—Continued

UTAH

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Antimony ore (concentrates)...short tons	6	$496	5	$371		
Arsenious oxide...do	(1)	(1)	(1)	(1)	(1)	(1)
Asphalt (native)...do	76,987	1,390,485	(1)	(1)	83,123	$1,414,422
Bismuth...pounds	(2)	(2)	(2)	(2)	(2)	(2)
Bitumen, natural sulfonated...short tons	(1)	(1)	(1)	(1)		
Cement...barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		(3) 1,000,000		(1 3)		(1 3)
Raw...short tons	(4) 17,905	(4) 43,465	(4) 26,152	(4) 65,208	(4) 55,395	(4) 90,295
Coal...do	6,665,936	19,977,743	7,119,261	22,032,130	6,644,000	22,922,000
Coke...do	324,829	(1 5)	760,874	(1 5)	735,511	(1 5)
Copper...pounds	647,978,000	84,237,140	565,150,000	76,295,250	452,752,000	61,121,520
Fluorspar...short tons	51	(1)	3,466	(1)	2,973	(1)
Fuller's earth...do	(1)	(1)	(1)	(1)	(1)	(1)
Gems and precious stones		(6)		(6)		(6)
Gold...troy ounces	390,470	13,666,450	344,223	12,047,805	279,979	9,799,265
Gypsum (crude)...short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron:						
Ore...long tons	911,839	(1)	1,540,594	1,742,876	1,925,572	2,170,334
Pig...short tons	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)	(1 5)
Lead...do	65,257	9,788,550	52,519	8,403,040	40,817	7,020,524
Lime...do	59,811	407,753	51,202	379,550	47,484	353,671
Manganese ore...do	91	3,083	30	(1)		
Manganiferous ore...do	18	(1)	32,141	(1)	5,001	(1)
Molybdenum...pounds	(1)	(1)	(1)	(1)	(1)	(1)
Natural gas...M cubic feet	4,464,000	962,000	6,223,000	1,535,000	6,680,000	1,685,000
Natural gasoline...gallons	666,000	35,000	924,000	50,000	(2)	(2)
Ores (crude), etc.:						
Copper...short tons	35,999,656	(7)	29,930,659	(7)	23,978,159	(7)
Dry and siliceous (gold and silver)...do	352,475	(7)	241,337	(7)	147,691	(7)
Lead...do	48,658	(7)	15,926	(7)	24,305	(7)
Lead-copper...do	53	(7)				
Zinc...do	231,845	(7)	95,968	(7)	104,499	(7)
Zinc-lead...do	753,930	(7)	656,065	(7)	468,530	(7)
Zinc-lead-copper...do	114	(7)	250	(7)		
Potassium salts...do	(1)	(1)	(1)	(1)	(1)	(1)
Salt (sodium chloride)...do	169,810	562,293	119,809	368,500	122,997	363,997
Sand and gravel...do	2,536,518	1,322,544	2,468,535	1,736,102	2,147,910	1,280,578

Silver .... troy ounces	9,479,340	6,740,864	7,593,075	5,399,520	6,106,545	4,342,432
Stone .... short tons	390,480	416,821	[8] 363,880	[8] 363,285	[8] 215,400	[8] 318,254
Sulfuric acid (60° B.)[9] .... do	(1, 5)	(1, 5)	(1, 5)	(1, 5)	(1, 5)	(1, 5)
Tungsten ore (60-percent concentrates) .... do	21	37,042	9	13,700	5	7,048
Vanadium .... pounds	833,680	523,117	287,045	261,765	97,572	58,154
Zinc .... short tons	46,896	10,129,536	38,994	8,890,632	33,630	7,734,900
Miscellaneous [10]	----	20,411,497	----	28,633,544	----	28,357,793
Total value, eliminating duplications	----	164,150,000	----	149,558,000	----	129,386,000

[1] Value included under "Miscellaneous."
[2] Figures not available.
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[5] Value not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] Exclusive of sandstone, value for which is included under "Miscellaneous."
[9] From copper smelting.
[10] Includes minerals indicated by "1" and "8" above.

VERMONT

Arsenious oxide .... short tons	----	----	(1)	(1)	(1)	(1)
Asbestos .... do	(2)	(2)	(2)	(2)	(2)	(2)
Clay:						
Products (other than pottery and refractories)	----	(2, 3)	----	(2, 3)	----	(2, 3)
Raw .... short tons	(2)	(2)	(2)	(2)	(2)	(2)
Copper .... pounds	580,000	$75,400	3,796,000	$512,460	(2)	(2)
Gold .... troy ounces	17	595	100	3,500	104	$3,640
Lime .... short tons	51,011	357,265	45,624	294,902	38,096	267,478
Mineral waters .... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Ores (crude), etc.: Copper .... short tons	17,046	(5)	91,289	(5)	82,943	(5)
Sand and gravel .... do	227,618	101,918	168,006	107,853	134,977	61,172
Silver .... troy ounces	2,721	1,935	18,862	13,413	20,586	14,639
Slate	----	1,284,288	----	1,384,544	----	1,691,825
Stone .... short tons	154,170	3,779,673	168,560	4,396,576	173,120	4,538,557
Talc .... do	56,458	658,471	60,692	724,556	64,046	737,181
Miscellaneous [6]	----	144,038	----	234,065	----	923,082
Total value, eliminating duplications	----	6,404,000	----	7,672,000	----	8,233,000

[1] Figures not available.
[2] Value included under "Miscellaneous."
[3] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "2" above.

Mineral products of the United States, 1943–45, by States—Continued

VIRGINIA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Aplite (crude) ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Bauxite ... do	(1)	(1)			(1)	(1)
Beryllium ore ... short tons	(1)	(1)	(1)	(1)		
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $1,600,000		[2] $1,200,000		[2] $1,254,665
Raw ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Coal ... do	20,280,209	59,923,217	19,513,874	62,946,274	18,105,000	61,140,000
Coke ... do	293,324	[3] 2,051,662	243,116	[3] 1,895,243	191,032	[3] 1,541,650
Copper ... pounds	200,000	26,000	582,000	78,570	140,000	18,900
Feldspar (crude) ... long tons	20,550	122,957	24,010	147,106	29,089	178,664
Ferro-alloys ... short tons	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)	(1 3)
Gems and precious stones		(4)		(4)		(4)
Gold ... troy ounces	50	1,750	132	4,620	12	420
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron:						
Ore ... long tons	7,490	(1)	6,716	(1)	(1)	(1)
Pig ... short tons			(1 3)	(1 3)	(1 3)	(1 3)
Kyanite ... do	(1)	(1)	(1)	(1)	(1)	(1)
Lead ... do	2,288	343,200	4,622	739,520	4,243	729,796
Lime ... do	194,974	1,338,675	154,160	1,129,342	118,707	835,575
Manganese ore ... do	7,040	238,435	20,172	623,080	8,566	307,976
Manganiferous ore ... do	12,208	73,451	4,419	(1)	392	(1)
Marl, calcareous ... do	61,724	73,698	68,707	84,207	88,936	122,135
Mica:						
Scrap ... do	1,499	31,529	1,700	38,294	376	7,720
Sheet ... pounds	5,829	15,863	15,082	57,906	2,983	2,395
Millstones		(1)		(1)		(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	77,000	74,000	57,000	56,000	54,000	54,000
Ores (crude), etc.:						
Copper ... short tons			1,926	(5)	1,047	(5)
Zinc ... do	35	(5)				
Zinc-lead ... do	528,016	(5)	528,688	(5)	449,290	(5)
Petroleum ... barrels	2,000	5,000	3,000	(1)	4,000	(1)
Phosphate rock ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Pyrites ... do	(1)	(1)	(1)	(1)	(1)	(1)
Quartz crystal ... pounds	(1)	(1)	(6)	(6)		
Salt ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... do	4,668,708	4,775,935	3,247,670	3,328,645	2,965,270	2,721,351
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz) ... do	(1)	(1)	75	303	(1)	(1)

Silver ..... troy ounces	14,947	10,629	18,993	13,506	1,300	924
Slate		260,864		(1)		(1)
Stone [7] ..... short tons	5,668,090	6,615,944	5,539,760	6,360,769	5,445,900	6,689,809
Talc and ground soapstone [7] ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Tantalum and columbium ore: Tantalum ore ..... pounds			(1)	(1)		
Titanium concentrates:						
Ilmenite ..... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Rutile ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Zinc ..... do	18,603	4,018,248	19,667	4,484,076	16,075	3,697,250
Miscellaneous [8]		12,113,541		11,907,004		11,186,298
Total value, eliminating duplications		85,825,000		87,001,000		84,081,000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] Value not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Figures not available.
[7] Soapstone used as dimension stone included in figures for stone.
[8] Includes minerals indicated by "1" above.

WASHINGTON

Aluminum ..... short tons	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Arsenious oxide ..... do	(3)	(3)	(3)	(3)	(3)	(3)
Cement ..... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[4] $900,000		[4] $1,100,000		[4] $1,336,877
Raw ..... short tons	[5] 100,338	[5] 127,236	[5] 54,473	[5] 97,449	[5] 183,009	[5] 204,837
Coal ..... do	1,527,544	6,729,906	1,524,141	7,358,966	1,376,000	7,238,000
Coke ..... do	14,853	(1 2)				
Copper ..... pounds	14,630,000	1,901,900	12,338,000	1,665,630	11,642,000	1,571,670
Diatomite ..... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Ferro-alloys ..... do	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)	(1 2)
Fluorspar ..... do					132	(1)
Gems and precious stones		(6)		(6)		(6)
Gold ..... troy ounces	65,244	2,283,540	47,277	1,654,695	57,860	2,025,100
Iron ore ..... long tons	13,455	(1)	8,695	(1)		
Lead ..... short tons	5,022	753,300	5,825	932,000	3,802	653,944
Lime ..... do	(1)	(1)	55,241	667,546	(1)	(1)
Magnesite ..... do	(1)	(1)	(1)	(1)	(1)	(1)
Magnesium ..... do	(1)	(1)	(1)	(1)		
Magnesium sulfate (natural) ..... pounds	358,000	10,000				
Manganese ore ..... short tons	7,731	(1)	5,199	(1)	6,994	(1)
Mineral waters ..... gallons sold	(6)	(6)	(6)	(6)	(6)	(6)
Ores (crude), etc.:						
Copper ..... short tons	2,339	(7)	36	(7)	38	(7)
Dry and siliceous (gold and silver) ..... do	61,220	(7)	62,063	(7)	53,174	(7)
Lead ..... do	374	(7)	477	(7)	1,800	(7)
Zinc ..... do	19,412	(7)	31,908	(7)	29,607	(7)
Zinc-copper ..... do	720,560	(7)	756,081	(7)	617,120	(7)
Zinc-lead ..... do	327,376	(7)	330,097	(7)	266,507	(7)

See footnotes at end of State table.

Mineral products of the United States, 1943–45, by States—Continued

WASHINGTON—Continued

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Peat ... short tons	(1)	(1)	(1)	(1)	2,032	$3,533
Pebbles for grinding ... do			(1)	(1)	(1)	(1)
Pulpstones ... do	63	$4,148				
Pumice ... do	700	7,362	783	$8,705	4,414	36,045
Quartz crystal ... pounds	(1)	(1)	(3)	(3)		
Sand and gravel ... short tons	[8] 5,183,374	[8] 3,403,720	6,946,153	4,076,976	6,949,809	3,872,633
Sand and sandstone (ground) ... do	3,902	25,485	(1)	(1)	(1)	(1)
Silica (quartz) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silver ... troy ounces	370,440	263,424	321,608	228,699	281,444	200,138
Stone ... short tons	2,081,810	2,499,550	[9] 2,538,690	[9] 2,756,332	[9] 3,741,250	[9] 3,773,096
Talc and ground soapstone ... do	1,998	11,822	3,288	34,103	2,249	27,591
Tungsten ore (60-percent concentrates) ... do	4	6,712	5	(1)	2	(1)
Zinc ... do	12,203	2,635,848	11,904	2,714,112	11,693	2,689,390
Miscellaneous [10]		88,762,789		82,244,887		60,861,900
Total value, eliminating duplications		37,593,000		86,483,000		31,588,000

[1] Value included under "Miscellaneous."
[2] Value not included in total value for State.
[3] Figures not available.
[4] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[5] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[6] No canvass.
[7] Not valued as ore; value of recoverable metal content included under the metals.
[8] "Commercial." Value of "Government-and-contractor" included under "Miscellaneous."
[9] Exclusive of marble, value for which is included under "Miscellaneous."
[10] Includes minerals indicated by "1," "8," and "9" above.

WEST VIRGINIA

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Bromine ... pounds	1,002,808	$95,391	(1)	(1)	(1)	(1)
Calcium chloride ... short tons	16,144	53,244	16,256	$52,506	(1)	(1)
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] 1,600,000		[2] 1,000,000		[2] $1,141,517
Raw ... short tons	[3] 72,529	[3] 140,286	[3] 68,898	[3] 134,312	[3] 348,080	[3] 1,003,868
Coal ... do	158,804,309	444,026,669	164,703,770	495,310,654	152,200,000	509,890,000
Coke ... do	3,035,376	[4] 13,513,440	3,016,548	[4] 14,255,640	2,750,331	[4] 14,167,585
Ferro-alloys ... do	167,621	[4] 26,601,660	(1 4)	(1 4)	(1 4)	(1 4)
Grindstones and pulpstones ... do	2,172	102,098	(1)	(1)	(1)	(1)
Iron, pig ... do	1,335,331	(1 4)	1,355,784	(1 4)	1,265,346	(1 4)
Lime ... do	492,292	3,401,706	493,724	3,464,019	511,509	3,620,401
Marl, calcareous ... do	(1)	(1)	(1)	(1)	(1)	(1)
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Natura gasl ... M cubic feet	223,787,000	91,679,000	181,452,000	74,743,000	160,000,000	67,265,000

Natural gasoline and allied products:						
Natural gasoline ... gallons	65,691,000	3,155,000	57,298,000	3,210,000	56,545,000	3,020,000
Liquefied petroleum gases ... do	32,251,000	1,300,000	31,619,000	1,335,000	34,116,000	1,000,000
Petroleum ... barrels	3,349,000	8,670,000	3,070,000	8,910,000	2,879,000	9,620,000
Salt ... short tons	230,329	923,499	359,217	1,027,109	370,260	903,759
Sand and gravel ... do	2,654,434	3,596,006	2,677,752	3,624,179	2,501,773	3,323,289
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	[6] 3,157,190	[6] 3,324,912	3,455,450	3,718,735	3,670,700	3,989,534
Sulfuric acid (60° B.) [7] ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Miscellaneous [8]		23,178,857		50,539,655		48,370,142
Total value, eliminating duplications		564,230,000		598,425,000		597,377,000

[1] Value included under "Miscellaneous."
[2] 1943-44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943-44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Exclusive of dimension limestone, value for which is included under "Miscellaneous."
[7] From zinc smelting.
[8] Includes minerals indicated by "1" and "6" above.

WISCONSIN

Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)		[2] $330,000		[2] $130,000		[2] $172,132
Raw ... short tons	(1)	(1)	(1)	(1)	[3] 61,071	[3] 46,734
Coke ... do	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)	(1 4)
Flint lining for tube mills ... do	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore ... long tons	1,392,173	3,822,025	1,536,737	4,190,380	1,295,647	3,575,133
Lead ... short tons	920	138,000	1,415	226,400	1,776	305,472
Lime ... do	82,913	633,399	138,750	1,030,322	124,560	988,422
Marl, calcareous ... do	(1)	(1)	22,416	8,410	811	801
Mineral waters ... gallons sold	(5)	(5)	(5)	(5)	(5)	(5)
Ores (crude), etc.:						
Zinc ... short tons	216,959	(6)	298,693	(6)	703,415	(6)
Zinc-lead ... do	331,063	(6)	325,118	(6)	254,262	(6)
Peat ... do	(1)	(1)	(1)	(1)	(1)	(1)
Pebbles for grinding ... do	(1)	(1)	(1)	(1)	(1)	(1)
Pyrites ... long tons	(1)	(1)	(1)	(1)	(1)	(1)
Sand and gravel ... short tons	6,223,375	2,595,531	8,634,769	4,128,434	8,384,279	4,111,282
Sand and sandstone (ground) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Silica (quartz) ... do	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	[7] 4,186,140	[7] 6,677,382	[7] 4,658,620	[7] 7,741,499	4,764,180	8,442,921
Zinc ... do	14,387	3,107,592	15,549	3,545,172	15,561	3,579,030
Miscellaneous [8]		7,281,975		7,955,975		7,244,766
Total value, eliminating duplications		18,930,000		22,794,000		22,213,000

[1] Value included under "Miscellaneous."
[2] 1943-44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943-44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] Value not included in total value for State.
[5] No canvass.
[6] Not valued as ore; value of recoverable metal content included under the metals.
[7] Exclusive of basalt, value for which is included under "Miscellaneous."
[8] Includes minerals indicated by "1" and "7" above.

Mineral products of the United States, 1943–45, by States—Continued

WYOMING

Product	1943 Quantity	1943 Value	1944 Quantity	1944 Value	1945 Quantity	1945 Value
Cement ... barrels	(1)	(1)	(1)	(1)	(1)	(1)
Clay:						
Products (other than pottery and refractories)	...	(1 2)	...	(1 2)	...	(1 2)
Raw ... short tons	[3] 159, 252	[3] $1, 389, 644	[3] 196, 138	[3] $1, 711, 193	[3] 206, 535	[3] $1, 694, 154
Coal ... do	9, 155, 123	21, 807, 231	9, 540, 012	25, 636, 793	9, 890, 000	29, 077, 000
Feldspar (crude) ... long tons	(1)	(1)	22, 415	81, 770	17, 021	62, 614
Fluorspar ... short tons	...	...	19	400	...	...
Gems and precious stones	...	(4)	...	(4)	...	(4)
Gold ... troy ounces	...	...	20	700	2	70
Gypsum (crude) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Iron ore ... long tons	814, 203	(1)	713, 759	(1)	606, 005	(1)
Lead ... short tons	...	...	...	...	3	516
Manganese ore ... do	60	(1)	...	...	...	...
Mica:						
Scrap ... do	59	614	(1)	(1)	(1)	(1)
Sheet ... pounds	558	248	...	...	(1)	(1)
Mineral waters ... gallons sold	(4)	(4)	(4)	(4)	(4)	(4)
Natural gas ... M cubic feet	34, 351, 000	6, 942, 000	34, 521, 000	7, 487, 000	34, 800, 000	7, 690, 000
Natural gasoline and allied products:						
Natural gasoline ... gallons	32, 358, 000	1, 698, 000	33, 181, 000	1, 962, 000	32, 953, 000	1, 865, 000
Liquefied petroleum gases ... do	3, 117, 000	141, 000	15, 699, 000	710, 000	17, 304, 000	800, 000
Ores (crude), etc.:						
Dry and siliceous (gold and silver) ... short tons	...	...	6	(5)	37	(5)
Lead ... do	...	...	...	...	15	(5)
Petroleum ... barrels	34, 253, 000	33, 570, 000	33, 356, 000	33, 290, 000	35, 359, 000	35, 800, 000
Sand and gravel ... short tons	2, 224, 941	978, 460	1, 460, 663	720, 381	1, 541, 369	693, 239
Silver ... troy ounces	...	...	3	2	31	22
Sodium sulfate (natural) ... short tons	(1)	(1)	(1)	(1)	(1)	(1)
Stone ... do	259, 360	197, 641	396, 660	383, 463	1, 551, 220	1, 321, 415
Vermiculite ... do	...	...	(1)	(1)	(1)	(1)
Miscellaneous [6]	...	4, 011, 903	...	2, 191, 358	...	2, 126, 625
Total value, eliminating duplications	...	70, 737, 000	...	74, 175, 000	...	81, 105, 000

[1] Value included under "Miscellaneous."
[2] 1943–44: Estimate by Bureau of Mines based on figures issued by Bureau of the Census covering certain classes of clay products; 1945: Figures obtained through cooperation with Bureau of the Census.
[3] 1943–44: Sold or shipped; 1945: Sold or used; value of clay used in cement and heavy clay products not included in total value for State.
[4] No canvass.
[5] Not valued as ore; value of recoverable metal content included under the metals.
[6] Includes minerals indicated by "1" above.

PART II. METALS

GOLD AND SILVER

By Charles White Merrill

SUMMARY OUTLINE

SUMMARY

Gold mining in the United States experienced more adverse effects from United States participation in World War II than any other large mineral industry. The ending of hostilities in 1945 at first gave promise of a speedy revival of the industry. War Production Board Order L–208 was rescinded, effective July 1, priority limitations on mining machinery were relaxed, and regulations curtailing the labor supply available to gold mines were revoked. The industry, however, responded very sluggishly to the returning freedom.

Although regulations affecting silver mining were not as harsh as those for gold, nevertheless domestic silver production declined uninterruptedly during World War II. War demand stimulated base-metal mining from which much domestic silver is a byproduct. Many of the increases in base-metal output, however, came from large low-grade mines where the silver content of the ores was very low, while production lagged at smaller base-metal mines where much of the byproduct silver is recovered. Gold mining is a substantial source of byproduct silver in the United States; WPB Order L–208, in suspending most gold-mining operations, reduced silver output as well.

Mine production of gold in the United States was 4 percent lower in 1945 than in 1944. Most States and districts in which gold was a byproduct of base-metal mining showed substantial decreases due to the reduction of copper, lead, and zinc outputs resulting largely from labor shortages. The declines at base-metal mines, however, were partly counterbalanced by large increases in some areas depending largely on straight gold ores and placers; South Dakota gold output increased 44,327 ounces or 381 percent, California 30,565 ounces or 26 percent, Alaska 18,821 ounces or 38 percent, Washington 10,583 ounces or 22 percent, and Oregon 3,098 ounces or 226 percent.

An analysis of 1945 gold production by methods of recovery reveals that over half the output was recovered by smelting of concentrates, whereas in prewar years amalgamation and cyanidation accounted for most of the lode gold produced. This shift was a result of the emphasis on base-metal mining and the curtailment of production at mines producing dry and siliceous gold ores.

Placer mining, which had experienced severe curtailment during the war, responded to relief from WPB Order L-208 more promptly than lode mining. Many placer operators found resumption of production easier than lode-mine operators because the placer mines and their equipment had deteriorated less and because the properties accounting for the bulk of the placer gold were near population centers and the recruitment of labor forces was thus facilitated.

Silver production, because the metal is closely associated with base metals in so many ores, had more nearly followed the course of base-metal output during the war period. Nevertheless, labor shortages and other difficulties had affected production adversely, with the result that the 1945 silver output was only 29,024,197 fine ounces, 40 percent of the recent record of 71,824,746 ounces produced in 1940.

Owing to restrictions on the international movement of gold and silver and the measures taken by governments to stabilize the exchange value of currencies, gold and silver lost much of their monetary significance. The eagerness of individuals to acquire the metals, however, appears to have increased, particularly where the monetary regulations were the most arbitrary. The press reported very high prices for both metals in a number of foreign markets. These prices were sustained, however, by various government regulations that restricted the movement of metals to the markets and the conversion of the proceeds of sales to the national currency of the seller. Moreover, some of the reported trading was being conducted in black markets. The reports of high gold prices led some domestic producers to advocate regulations under the Gold Reserve Act that would permit the free export of gold. Free export, however, would not insure profitable access to foreign markets because foreign gold import laws in most, if not all instances, provided that the gold be received by the foreign treasury or state bank; the price to be paid for it when exchanged was not to exceed $35 a fine ounce. Export of silver like that of gold did not offer domestic producers any prospect of profit over what could be derived from local sale.

The Treasury buying prices of $35 per fine ounce for gold and $0.7111+ per fine ounce for domestically mined silver remained unchanged throughout 1945. The Office of Price Administration fixed the ceiling price for domestically mined silver at $0.7111+ an ounce and of foreign silver at $0.45. On September 21, however, the OPA ceiling on foreign silver was raised to equal that for domestic silver.

The outflow of gold and silver from the United States in 1944, after a decade in which imports regularly exceeded exports, continued in 1945 but at a reduced rate. The net loss of gold in 1945 was worth $106,249,890, compared with $845,391,564 in 1944; comparable figures for silver were $63,658,505 and $103,542,307, respectively.

Salient statistics of gold and silver in the United States,[1] 1941–45

	1941	1942	1943	1944	1945
Mine production, fine ounces:					
Gold	4, 750, 865	3, 457, 110	1, 363, 815	998, 394	954, 572
Silver	67, 258, 997	54, 090, 765	41, 460, 826	34, 473, 540	29, 024, 197
Number of mines producing gold and silver:					
Lode	4, 542	2, 619	1, 394	1, 186	1, 112
Placer	3, 349	1, 758	362	367	440
Ore (dry and siliceous) produced (short tons):					
Gold ore	15, 117, 117	9, 487, 907	3, 766, 149	1, 964, 680	1, 364, 308
Gold-silver ore	1, 447, 371	1, 163, 970	553, 566	364, 698	276, 530
Silver ore	1, 074, 543	996, 823	643, 271	290, 297	343, 458
Percentage derived from—					
Dry and siliceous ores:					
Gold	55	50	38	30	30
Silver	41	37	26	17	24
Base metal ores:					
Gold	14	21	50	58	51
Silver	59	63	74	83	76
Placers:					
Gold	31	29	12	12	19
Silver	(2)	(2)	(2)	(2)	(2)
Net industrial consumption:					
Gold	$37, 001, 620	$47, 294, 810	$86, 343, 353	[3] $97, 298, 283	$108, 944, 332
Silver, fine ounces	72, 432, 318	101, 398, 695	118, 000, 000	120, 100, 000	126, 300, 000
Imports:					
Gold	$982, 442, 027	$315, 779, 716	$101, 792, 745	$113, 836, 359	$93, 718, 050
Silver	$47, 053, 413	$41, 103, 149	$27, 902, 960	$23, 373, 037	$27, 278, 396
Exports:					
Gold	$64, 280	$102, 126	$32, 854, 590	$959, 227, 923	$199, 967, 940
Silver	$5, 673, 361	$1, 999, 490	$30, 689, 397	$126, 915, 344	$90, 936, 901
Monetary stocks:[4]					
Gold	[3] $22,736,000,000	$22, 726, 000, 000	$21, 938, 000, 000	$20, 619, 000, 000	$20, 065, 000, 000
Silver, fine ounces	2, 872, 000, 000	2, 838, 000, 000	2, 687, 000, 000	2, 345, 000, 000	2, 005, 000, 000
Price, average, per fine ounce:					
Gold	$35.00	$35.00	$35.00	$35.00	$35.00
Silver	$0.711+	$0.711+	$0.711+	$0.711+	$0.711+
World production, fine ounces:					
Gold	40, 160, 000	35, 400, 000	29, 300, 000	27, 070, 000	23, 930, 000
Silver	261, 566, 000	247, 749, 000	217, 041, 000	186, 200, 000	(5)

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.5 percent.
[3] Revised.
[4] Owned by Treasury Department; privately held coinage not included.
[5] Data not available.

LEGISLATION AND REGULATIONS

Although some new legislation was proposed during 1945, the principal changes in law and wartime regulations affecting gold and silver took the form of expiration of legislation and the rescinding of regulations. Several WPB Orders were revoked during the year Amendments removed limitations on the use of silver for uses classified as nonessential, but the revocation that affected the industry most widely was the rescission of Limitation Order L–208, which had forced most gold mines to lie idle after October 8, 1942. Before the order was rescinded, however, its restrictions had been relaxed to some extent by WPB grants to individual operators, which permitted operation of specified mines, usually on a severely curtailed basis. For example, one lode gold mine was granted permission to hire up to 175 men compared with a prewar crew averaging 1,000, and a dredge was granted permission to operate on a one-shift basis.

The Green Act, which permitted the sale of Treasury-held silver at 71.11+ cents an ounce for war and certain other purposes, expired December 31, 1945, before a bill extending the sale authority had been acted upon by the Congress. Legislation proposed but not passed during 1945 included bills providing relief for miners who had experienced losses attributable to Government action during the war, one particularly for gold mines closed by Order L-208, and bills authorizing silver purchase by the Treasury at prices exceeding 71.11+ cents an ounce.

Presidential approval on June 12, 1945, of an Act of Congress amending the Federal Reserve Act permitted reduction in the gold-reserve requirements of Federal Reserve banks against Federal Reserve notes in circulation and deposit liabilities from 40 to 25 percent. Thus, the need for additional gold to back rapidly expanding money requirements of the United States was sharply reduced, and a growing pressure for a higher price for gold or a lower price and wage level was relieved at least temporarily.

INTERNATIONAL MONETARY AGREEMENTS

The agreements formulated by the representatives of 44 nations at Bretton Woods, N. H., in July 1944 were in the process of ratification by the governments of the participating nations during 1945. Two of the most-important institutions created by the conference were the International Monetary Fund and an International Bank for Reconstruction and Development. The aims of the Fund are to promote exchange and currency stability as a means of restoring world trade; to establish a procedure for devaluating exchange when necessary; to eliminate such destructive practices as indiscriminate exchange restrictions, multiple currency practices, and bilateral clearing agreements; to assure member countries that the proceeds of sales to any one member can be used for the purchase of goods from any other member; and to reestablish international currencies on a gold basis, seemingly as a form of modified gold standard.

The Fund is intended to operate on a short-loan basis, to provide a revolving fund to meet temporary shortages in the balance of payments of the member countries. It was pointed out that such a fund cannot be used in the hope of curing the basic economic ills of a nation but at best can only tide over the country for the time being and that in the final analysis currency stability is not a matter of monetary mechanisms alone but depends primarily on a stable government and sound internal economic policies.

Holdings for the Fund would be built through assigned member quotas in gold and national currencies and would total $8,800,000,000 for the countries represented at the conference. The gold part of the subscription would be a minimum of 25 percent of the country's quota or 10 percent of its net official holdings of gold and United States dollars, whichever is smaller. The quota of the United States was placed at $2,750,000,000, of which about $687,500,000 would be required in gold.

Participation of the United States was authorized by the Bretton Woods Act approved by the President July 31, 1945. The Fund and the Bank came into existence on December 27, 1945, when the agreements were signed in Washington on behalf of governments contributing approximately 80 percent of the total subscriptions. Several others signed before the end of the year. Of the 44 governments that were eligible to sign before December 31 and become original members of the Fund and Bank, only 9 did not do so; they were Russia, Australia, New Zealand, Venezuela, Haiti, El Salvador, Nicaragua, Panama, and Liberia. Colombia signed the Fund Agreement but not the Bank Agreement.

The provisions of the Bretton Woods Agreement for the use of gold in international monetary transactions appeared to be an important move toward reestablishment of gold's historic function in international trade. During the war period the conversion of currencies to gold and the international movement of gold had been very severely restricted. In fact, even before the declaration of war in September 1939 the barter procedures in carrying on international trade had relegated gold to a subsidiary position in large areas where much of the world's trade is generated. The Agreement gave silver little monetary recognition.

DOMESTIC PRODUCTION

Production of gold and silver in the United States is measured at mines and at refineries. Both measures are tabulated by States of origin, but there is a small annual variation between them explained largely by time lag. Over a period of years the variations are found to be negligible. Compared with the mine reports compiled by the Bureau of Mines, the refinery reports compiled by the Bureau of the Mint in cooperation with the Bureau of Mines for the 41 years, 1905 to 1945, show a total excess of gold of 312,482 ounces (a difference of 0.22 percent) and a total excess of silver of 13,478,268 ounces (a difference of 0.58 percent).

Gold and silver produced in the United States, 1905–45, in fine ounces, according to mint and mine returns, in terms of recovered metals

Year	Mint		Mine	
	Gold	Silver	Gold	Silver
1905–40	130, 928, 821	2, 095, 399, 365	130, 852, 038	2, 088, 172, 477
1941	5, 976, 419	72, 336, 029	5, 881, 798	68, 483, 333
1942	3, 741, 806	56, 090, 855	3, 615, 836	54, 321, 962
1943	1, 394, 522	40, 900, 121	1, 377, 579	41, 486, 897
1944	1, 022, 238	35, 651, 049	998, 394	34, 473, 540
1945	928, 893	29, 063, 255	954, 572	29, 024, 197
	143, 992, 699	2, 329, 440, 674	143, 680, 217	2, 315, 962, 406

MINE PRODUCTION

Domestic gold and silver production depended largely on base-metal output in 1945. This dependency had characterized silver production for many years as a result of the peculiar nature of argentiferous ores. Rising costs and WPB Order L–208 closed most mines worked principally for gold, with the result that byproduct gold from base-metal (principally copper, lead, and zinc) mining has accounted for over half the gold output since 1942 for the first time on record.

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Although Order L-208 was rescinded, effective July 1, gold mining made only moderate headway during the remaining 6 months of 1945. The gold output during the last quarter of the year exceeded that for the first quarter by 44 percent. However, the rate of production during the last quarter was only 25 percent of that for the all-time peak year 1940.

Silver production also declined during the war period despite great efforts to stimulate output at base-metal mines, many of which produced silver-bearing ore. This downward trend became pronounced during the latter part of 1945, when the efforts to produce copper, lead, and zinc slackened. The decline at the base-metal mines, however, was general, owing to persistent labor, equipment, and supply shortages. Moreover, the importance of small base-metal mines where silver commonly makes up a large proportion of the revenue decreased in comparison with the large-tonnage mines, treating low-grade ore (usually low silver) where mechanization permitted a high yield of base metal per man employed.

Production and value of gold and silver in the United States, in 1945, by months

	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
January	66,686	$2,334,010	2,600,214	$1,849,041
February	67,381	2,358,335	2,484,857	1,767,009
March	73,947	2,588,145	2,878,582	2,046,992
April	71,347	2,497,145	2,466,547	1,753,989
May	76,502	2,677,570	2,750,410	1,955,847
June	68,998	2,414,930	2,393,864	1,702,303
July	71,656	2,507,960	2,316,224	1,647,093
August	75,706	2,649,710	2,305,526	1,639,485
September	83,466	2,921,310	2,177,312	1,548,311
October	92,325	3,231,375	2,288,566	1,627,425
November	100,104	3,503,640	2,350,294	1,671,320
December	106,454	3,725,890	2,011,801	1,430,614
	954,572	33,410,020	29,024,197	20,639,429

UNITS OF MEASUREMENT

All tonnage figures are short tons of 2,000 pounds "dry weight"; that is, they do not include moisture. Figures in cubic yards used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before excavation. The weight unit for gold and silver is the troy ounce (480 grains). The totals are calculated upon the basis of recovered and recoverable fine gold and silver shown by assays to be contained in ore, bullion, and other material produced. Prices of gold and silver are discussed in a later section of this report.

NUMBER OF MINES

The following table indicates the number of mines that produced gold and silver in 1944 and 1945. The placers are those in which gold and silver in natural alloy and, in a few placers, platinum are recovered from gravel. Except for such small-scale hand methods as those utilizing the gold pan, the rocker, or the dry washer, all recovery methods employ sluice boxes; methods are distinguished by the means used for delivering the gravel to the sluices. Those methods where gravel is delivered mechanically include connected-bucket dredging, dragline dredging, and treatment in nonfloating washing plants of gravel delivered by power shovel, dragline excavator, truck, slackline scraper, or other mechanical means. In the hydraulic method the gravel is mined from the bank by a powerful jet of water; in some small-scale hand methods the gravel is shoveled into sluices; and in drift operations the gravel is mined underground and delivered to sluices at the surface. The lode mines are those yielding gold and silver from ore as distinguished from gravel, mainly from underground workings, and include those that yield ore mined chiefly for copper, lead, zinc, or other metals but that contribute the precious metals as byproducts. As far as possible the unit is not the operator but the mining claim or group of claims.

Number of mines in the United States producing gold or silver, 1944–45, by States

State	Lode		Placer		Total	
	1944	1945	1944	1945	1944	1945
Alabama		1				1
Alaska	9	18	198	200	207	218
Arizona	221	193	17	18	238	211
California	109	87	66	99	175	186
Colorado	193	195	13	41	206	236
Georgia			2		2	
Idaho	112	115	20	27	132	142
Illinois	2	2			2	2
Michigan	2	1			2	1
Missouri	3	2			3	2
Montana	187	157	24	26	211	183
Nevada	145	163	11	12	156	175
New Mexico	53	44	3	4	56	48
New York	1	1			1	1
North Carolina	3				3	
Oregon	13	9	10	10	23	19
Pennsylvania	1	1			1	1
South Carolina						
South Dakota	2	3			2	3
Tennessee	1	1			1	1
Texas	3	4			3	4
Utah	97	89			97	89
Vermont	1	1			1	1
Virginia	2	2			2	2
Washington	25	21	3	3	28	24
Wyoming	1	2			1	2
	1,186	1,112	367	440	1,553	1,552

PRINCIPAL MINING DISTRICTS AND LEADING MINES

One of the anomalies of war economy has been the emergence of a copper district, West Mountain (Bingham), Utah, as the leading gold producer in the United States, surpassing Lawrence County (Lead), S. Dak., in 1943, 1944, and 1945. In fact, of the four leading districts in 1945 three accounting for 35 percent of the United States total output of gold were classified as copper districts.

Mine production of recoverable gold in the United States, by districts that produced 15,000 fine ounces or more during any year, 1941–45, in fine ounces [1]

District	State	1941	1942	1943	1944	1945
West Mountain (Bingham)	Utah	275,119	327,258	343,551	312,493	248,923
Lawrence County	South Dakota	596,109	520,006	106,444	11,621	55,947
Robinson (Ely)	Nevada	68,057	74,609	64,323	48,120	45,063
Chelan Lake	Washington	45,910	48,364	41,920	26,198	40,207
Folsom	California	147,985	109,206	16,065	23,789	32,851
Grass Valley-Nevada City	do	276,451	155,797	20,605	(2)	31,064
Yuba River	do	73,964	(2)	(2)	(2)	(2)
Cripple Creek	Colorado	133,470	104,455	45,105	30,886	28,524
Ajo	Arizona	40,405	45,081	45,108	29,020	24,772
Animas	Colorado	17,105	17,078	21,188	28,450	21,870
Upper San Miguel	do	23,981	23,446	20,204	18,542	17,779
Republic	Washington	34,115	24,981	22,638	20,479	17,363
Warren (Bisbee)	Arizona	61,727	58,692	57,042	38,401	15,863
California (Leadville)	Colorado	19,346	27,115	23,150	20,149	15,706
Tintic	Utah	23,950	23,819	22,470	11,417	14,536
Park City	do	19,747	22,935	19,559	15,149	13,822
Summit Valley (Butte)	Montana	23,130	21,651	16,020	14,441	12,052
Potosi	Nevada	(2)	46,625	35,047	(2)	10,752
Manhattan	do	24,140	26,397	11,777	7,689	9,870
Verde	Arizona	32,047	28,429	18,117	8,620	8,602
Big Bug	do	15,668	9,482	6,860	5,409	8,395
La Grange	California	13,423	17,514	4,445	5,018	7,544
Camanche	do	25,352	17,111	5,071	(2)	(2)
Mother Lode	do	190,735	104,437	16,420	7,140	5,126
Oroville	do	68,859	50,029	14,533	9,859	4,217
Alleghany	do	15,001	11,301	(2)	(2)	(2)
Sumpter	Oregon	17,612	13,087	17	13	2,557
Boise Basin	Idaho	21,882	14,412	358	426	1,858
Igo	California	20,261	9,594	189	47	(2)
Snelling	do	43,184	19,986	81	5	(2)
Klamath River	do	38,755	21,695	2,629	3,256	(2)
Callahan	do	15,513	8,340	19	17	(2)
Middle Boise	Idaho	28,240	29,491	13,868	4,650	666
Comstock	Nevada	42,981	33,162	5,253	3,655	661
East Belt	California	31,720	12,662	1,203	598	(2)
Camp Floyd	Utah	29,980	12,463	2,529	1,926	604
Summitville	Colorado	16,979	5,499	3,287	2,154	560
Old Hat	Arizona	31,979	26,200	16,185	6,389	471
Cosumnes River	California	31,660	15,909	91	----------	389
Silver Peak	Nevada	26,675	8,459	2,744	628	241
Mojave	California	60,219	46,494	1,544	975	223
Cedar Plains	Montana	15,307	8,779	2,330	18	171
Jenny Lind	California	(2)	8,028	158	50	167
Mosquito	Colorado	22,940	15,009	6,298	622	128
Red Cliff	do	25,162	2,040	421	448	117
Silver City	Nevada	14,350	24,025	70	----------	81
Weaver (Yavapai County)	Arizona	20,190	13,301	597	58	49
Ophir	California	34,069	19,487	510	15	23
San Francisco (Oatman, Goldroad, Katherine, Vivian)	Arizona	42,098	28,570	2,960	21	10
Renova	Montana	20,343	9,818	142	17	2
Granite	Oregon	19,635	(2)	1	110	----------
Kershaw	South Carolina	15,226	7,384	----------	----------	----------

[1] Exclusive of Alaska.
[2] Bureau of Mines not at liberty to publish.

The leading silver districts for many years have included many more noted for base-metal output than silver yield. Although the war demand for copper, lead, and zinc brought out much byproduct silver, the general order of districts was not nearly so disturbed by war as in the gold list.

Mine production of recoverable silver in the United States by districts that produced 200,000 fine ounces or more during any year, 1941–45, in fine ounces

District	State	1941	1942	1943	1944	1945
Summit Valley (Butte)	Montana	8,988,501	8,123,334	6,485,123	5,955,608	4,936,770
Evolution	Idaho	9,581,130	7,341,871	5,745,721	5,211,502	4,348,717
West Mountain (Bingham)	Utah	4,851,872	5,399,744	5,404,365	4,671,478	3,628,229
Yreka	Idaho	2,291,559	2,458,890	2,237,469	1,811,939	1,485,827
Tintic	Utah	2,711,790	2,059,193	1,554,989	1,070,214	1,086,435
Park City	do	3,271,199	2,632,109	2,001,555	1,429,650	1,033,830
Warren (Bisbee)	Arizona	2,671,238	2,484,135	2,252,250	1,550,506	963,180
Hunter	Idaho	1,143,713	1,085,833	928,378	735,286	581,047
Coso (Darwin)	California	1,855	53,072	138,662	252,900	575,069
Verde	Arizona	1,544,317	1,532,108	1,036,194	589,538	475,290
Warm Springs	Idaho	753,532	639,616	715,074	618,947	460,357
Creede	Colorado	906,712	805,202	630,952	518,161	433,177
California (Leadville)	do	114,103	241,301	379,513	496,634	417,427
Lelande	Idaho	1,267,771	1,580,026	967,569	521,339	383,476
Pioche	Nevada	929,884	487,253	408,721	444,309	350,259
Copper Mountain (Morenci)	Arizona	44,903	165,645	195,248	281,153	345,863
Big Bug	do	325,471	316,921	244,191	229,490	320,559
Animas	Colorado	527,490	391,794	323,706	228,015	301,957
Ajo	Arizona	423,000	489,759	478,284	319,320	285,719
Upper San Miguel	Colorado	447,843	314,903	210,763	169,650	274,559
Pioneer (Superior)	Arizona	794,406	725,137	476,751	386,429	251,062
Flint Creek	Montana	480,375	526,275	245,447	249,141	208,260
Central	New Mexico	476,138	224,914	181,264	216,554	(1)
Rush Valley	Utah	(1)	(1)	(1)	(1)	(1)
Bayhorse	Idaho	221,182	193,379	211,119	270,644	200,631
Robinson (Ely)	Nevada	374,337	273,939	254,046	213,663	199,970
Placer Center	Idaho	275,189	368,730	313,716	278,723	196,806
Harshaw	Arizona	367,027	343,357	204,404	176,438	144,841
Southeastern Missouri	Missouri	367,688	69,106	111,285	92,243	94,822
Mogollon	New Mexico	489,926	210,243	47,368	61,349	91,786
Roaring Fork	Colorado	238,773	286,131	302,386	126,232	78,362
Montana	Montana	1,104,047	730,101	196,155	91,409	72,675
Resting Springs	California	(1)	210,503	153,540	92,818	(1)
Wallapai	Arizona	213,577	157,112	88,695	57,856	49,708
Red Cliff	Colorado	4,352,677	395,252	176,116	134,211	49,171
Jack Rabbit	Nevada	305,799	242,644	98,474	59,639	48,929
Tonopah	do	377,534	334,712	159,141	91,215	48,434
Hog Heaven	Montana	665,138	770,206	490,050	93,330	40,500
Steeple Rock	New Mexico	252,509	60,220	20,870	21,181	25,494
Grass Valley-Nevada City	California	444,206	299,933	103,334	(1)	12,077
Barker	Montana	1,845	215,235	212,625	4,067	5,535
Comstock	Nevada	539,058	298,654	123,373	44,065	4,646
Mojave	California	853,009	589,839	9,658	727	208
Silver Peak	Nevada	748,973	649,206	209,070	696	90
Barrett Springs	do	469,551	106,678	35	(1)	10
Eldorado Canyon	do	367,802	198,090	11,963	215	
Carson (French)	Idaho	254,991	206,325	793		
Sand Springs	Nevada	298,499	(1)			

(1) Bureau of Mines not at liberty to publish.

The 25 leading gold-producing mines were almost evenly divided between gold mines and base-metal mines; of the gold mines three were placers, all using connected-bucket dredges. The 5 leading mines contributed 40 percent of the total gold produced in the United States in 1945; the 10 leading mines accounted for 53 percent; and the list of 25, 70 percent.

Only 4 of the 25 leading silver-producing mines depended exclusively on silver ore; ores valuable chiefly for copper, lead, zinc, and gold accounted for most of the silver production. The 5 leading mines contributed 36 percent of the total silver produced in the United States in 1945; the 10 leading mines, 48 percent; and the list of 25, 65 percent. As several operators worked more than one of the leading silver mines as well as smaller producers, the output of silver by companies was substantially more concentrated than by mines.

Twenty-five leading gold-producing mines in the United States in 1945, in order of output

Rank	Mine	District	State	Operator	Source of gold
1	Utah Copper	West Mountain (Bingham)	Utah	Utah Copper Co	Copper ore.
2	Homestake	Whitewood	South Dakota	Homestake Mining Co	Gold ore.
3	Holden	Chelan Lake	Washington	Howe Sound Co	Zinc-copper ore.
4	Yuba unit	Yuba River	California	Yuba Consolidated Gold Fields	Dredge.
5	Ruth and Copper Flat pit	Robinson (Ely)	Nevada	Kennecott Copper Corp	Copper ore.
6	Natomas	Folsom	California	Natomas Co	Dredge.
7	Cripple Creek mines	Cripple Creek	Colorado	Golden Cycle Corp	Gold ore.
8	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
9	Idaho Maryland Brunswick	Grass Valley-Nevada City	California	Idaho Maryland Mines Corp	Gold ore.
10	Dives group and Silver Lake group	Animas	Colorado	Shenandoah-Dives Mining Corp	Gold-silver ore, gold ore.
11	Knob Hill	Republic	Washington	Knob Hill Mines, Inc	Gold ore.
12	Coppermines group	Robinson (Ely)	Nevada	Consolidated Coppermines Corp	Copper ore.
13	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co.	Zinc-lead ore, gold-silver ore, lead ore.
14	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper ore, lead ore, zinc-lead ore.
15	Park Galena & Mayflower	Park City	Utah	New Park Mining Co	Zinc-lead ore, silver ore.
16	Smuggler Union	Upper San Miguel	Colorado	Telluride Mines, Inc	Gold ore.
17	Getchell	Potosi	Nevada	Getchell Mine, Inc	Do.
18	Butte mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper ore, silver ore, zinc ore.
19	Manhattan dredge	Manhattan	Nevada	Manhattan Gold Dredging Co	Dredge.
20	Goldacres	Bullion	do	Willow Creek Mines, Inc	Gold ore.
21	United Verde	Verde	Arizona	Phelps Dodge Corp	Copper ore.
22	Tintic Bullion	Tintic	Utah	North Lily Mining Co	Gold ore, zinc-lead ore.
23	Empire Star group	Grass Valley-Nevada City	California	Empire Star Mines Co., Ltd	Gold ore.
24	Resurrection group	California (Leadville)	Colorado	Resurrection Mining Co	Zinc-lead ore, gold ore.
25	Jardine	Sheepeater	Montana	Jardine Mining Co	Gold ore.

Twenty-five leading silver-producing mines in the United States in 1945, in order of output

Rank	Mine	District	State	Operator	Source of silver
1	Butte mines	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Copper ore, silver ore, zinc ore.
2	Utah Copper	West Mountain (Bingham)	Utah	Utah Copper Co	Copper ore.
3	Sunshine	Evolution	Idaho	Sunshine Mining Co	Silver ore.
4	United States and Lark	West Mountain (Bingham)	Utah	U. S. Smelting, Refining & Mining Co	Zinc-lead ore, gold-silver ore, lead ore.
5	Polaris	Evolution	Idaho	Sunshine Mining Co	Silver ore.
6	Copper Queen	Warren (Bisbee)	Arizona	Phelps Dodge Corp	Copper ore, lead ore, zinc-lead ore.
7	Osburn tailings	Evolution	Idaho	Hecla Mining Co	Zinc-lead old tailings.
8	Bunker Hill and Sullivan	Yreka	do	Bunker Hill & Sullivan Mining & Concentrating Co.	Zinc-lead ore.
9	St. Germaine and Purim	Evolution	do	Silver Dollar Mining Co	Silver ore.
10	Darwin group	Coso (Darwin)	California	Darwin Mines (Arthur J. Theis, trustee) and Anaconda Copper Mining Co.	Zinc-lead ore.
11	United Verde	Verde	Arizona	Phelps Dodge Corp	Copper ore.
12	Tintic Standard	Tintic	Utah	Tintic Standard Mining Co	Silver ore, lead ore.
13	Independence group	Warm Springs	Idaho	Triumph Mining Co	Zinc-lead ore.
14	Emperius group	Creede	Colorado	Emperius Mining Co	Silver ore.
15	Morenci	Copper Mountain	Arizona	Phelps Dodge Corp	Copper ore.
16	Park Galena and Mayflower	Park City	Utah	New Park Mining Co	Zinc-lead ore, silver ore.
17	Page	Yreka	Idaho	Federal Mining & Smelting Co	Zinc-lead ore.
18	Iron King	Big Bug	Arizona	Shattuck Denn Mining Corp	Zinc-lead ore, gold-silver ore.
19	Daly West, Ontario, and Judge	Park City	Utah	Park Utah Consolidated Mng. Co	Zinc-lead ore.
20	Silver King	do	do	Silver King Coalition Mines Co	Zinc-lead ore, lead ore, silver ore.
21	New Cornelia	Ajo	Arizona	Phelps Dodge Corp	Copper ore.
22	Morning	Hunter	Idaho	Federal Mining & Smelting Co	Zinc-lead ore.
23	Chief, Gemini, and Eureka Hill	Tintic	Utah	Chief Consolidated Mining Co	Zinc-lead ore, silver ore, lead ore.
24	Emma and Ophir	Summit Valley (Butte)	Montana	Anaconda Copper Mining Co	Manganese ore, zinc-lead ore.
25	Sherman	Lelande	Idaho	Sherman Lead Co	Zinc-lead ore.

Gold and silver produced in the Western States of the United States, 1848–1945, and in Alaska, 1880–1945, in terms of recovered metals [1]

State	Period	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
Alaska	1880–1945	25, 856, 647	$617, 997, 247	19, 748, 505	$14, 047, 822
Arizona	1860–1945	11, 789, 135	265, 114, 880	289, 418, 649	214, 623, 537
California	1848–1945	101, 524, 395	2, 255, 457, 477	106, 857, 437	86, 056, 080
Colorado	1858–1945	38, 915, 330	855, 913, 514	728, 186, 527	565, 760, 083
Idaho	1863–1945	7, 797, 774	176, 061, 493	513, 994, 308	353, 787, 181
Montana	1862–1945	16, 981, 614	378, 809, 702	745, 876, 683	544, 431, 355
Nevada	1859–1945	25, 426, 321	568, 482, 911	588, 353, 061	539, 716, 076
New Mexico	1848–1945	2, 178, 826	49, 593, 103	67, 416, 731	52, 672, 094
Oregon	1852–1945	5, 673, 954	126, 551, 433	5, 218, 385	4, 785, 838
South Dakota	1876–1945	20, 734, 054	507, 289, 099	9, 601, 108	6, 829, 842
Texas	1885–1945	8, 281	223, 780	33, 225, 441	23, 380, 380
Utah	1864–1945	10, 464, 445	266, 480, 615	715, 054, 066	520, 758, 052
Washington	1860–1945	2, 127, 502	53, 217, 893	12, 565, 420	8, 895, 835
Wyoming	1867–1945	77, 936	1, 836, 088	74, 666	51, 776
Total, Western States and Alaska	1848–1945	269, 556, 214	6, 123, 029, 235	3, 835, 590, 987	2, 935, 795, 951

[1] The estimates for 1848–1903 are by Chas. W. Henderson and, since then, by Metal Economics Division, Bureau of Mines.

The following table gives the mine production of gold and silver in 1944 and 1945, by States, in terms of recovered metals, as calculated by the Bureau of Mines from reports from the producing mines.

Mine production of gold and silver in the United States, 1944–45, by regions and States, in terms of recovered metals [1]

Region and State	Gold					Silver				
	Fine ounces		Increase or decrease (percent)	Value (at $35 per ounce)		Fine ounces		Increase or decrease (percent)	Value (at $0.71111+ per ounce)	
	1944	1945		1944	1945	1944	1945		1944	1945
Western States and Alaska:										
Alaska	49, 296	68, 117	+38	$1, 725, 360	$2, 384, 095	13, 362	9, 983	−25	$9, 502	$7, 099
Arizona	112, 162	77, 223	−31	3, 925, 670	2, 702, 805	4, 394, 039	3, 558, 216	−19	3, 124, 650	2, 530, 287
California	117, 373	147, 938	+26	4, 108, 055	5, 177, 830	778, 936	986, 798	+27	553, 910	701, 723
Colorado	111, 455	100, 935	−9	3, 900, 925	3, 532, 725	2, 248, 830	2, 226, 780	−1	1, 599, 168	1, 583, 488
Idaho	25, 008	17, 780	−29	875, 280	622, 300	9, 931, 614	8, 142, 667	−18	7, 062, 481	5, 790, 341
Montana	50, 021	44, 597	−11	1, 750, 735	1, 560, 895	7, 093, 215	5, 942, 070	−16	5, 044, 064	4, 225, 472
Nevada	119, 056	92, 265	−23	4, 166, 960	3, 229, 275	1, 259, 636	1, 043, 380	−17	895, 741	741, 959
New Mexico	6, 918	5, 604	−19	242, 130	196, 140	535, 275	465, 127	−13	380, 640	330, 757
Oregon	1, 369	4, 467	+226	47, 915	156, 345	20, 243	10, 461	−48	14, 395	7, 439
South Dakota	11, 621	55, 948	+381	406, 735	1, 958, 180	5, 445	26, 564	+388	3, 872	18, 890
Texas						5, 355	23, 265	+334	3, 808	16, 544
Utah	344, 223	279, 979	−19	12, 047, 805	9, 799, 265	7, 593, 075	6, 106, 545	−20	5, 399, 520	4, 342, 432
Washington	47, 277	57, 860	+22	1, 654, 695	2, 025, 100	321, 608	281, 444	−12	228, 699	200, 138
Wyoming	20	2	−90	700	70	3	31	+933	2	22
	995, 799	952, 715	−4	34, 852, 965	33, 345, 025	34, 200, 636	28, 823, 331	−16	24, 320, 452	20, 496, 591
Eastern States:										
Alabama		5			175		1			1
Georgia	5		−100	175						
New York						25, 238	14, 271	−43	17, 947	10, 148
North Carolina	21		−100	735		1, 461		−100	1, 039	
Pennsylvania	2, 115	1, 588	−25	74, 025	55, 580	13, 545	10, 434	−23	9, 632	7, 420
South Carolina										
Tennessee	222	148	−33	7, 770	5, 180	45, 907	35, 391	−23	32, 645	25, 167
Vermont	100	104	+4	3, 500	3, 640	18, 862	20, 586	+9	13, 413	14, 639
Virginia	132	12	−91	4, 620	420	18, 993	1, 300	−93	13, 506	924
	2, 595	1, 857	−28	90, 825	64, 995	124, 006	81, 983	−34	88, 182	58, 299
Central States:										
Illinois						2, 437	2, 198	−10	1, 733	1, 563
Michigan						54, 218	21, 863	−60	38, 555	15, 547
Missouri						92, 243	94, 822	+3	65, 595	67, 429
						148, 898	118, 883	−20	105, 883	84, 539
	998, 394	954, 572	−4	34, 943, 790	33, 410, 020	34, 473, 540	29, 024, 197	−16	24, 514, 517	20, 639, 429

[1] Philippine Islands and Puerto Rico excluded.

ORE PRODUCTION, CLASSIFICATION, METAL YIELD, AND METHODS OF RECOVERY

A better index of lode mining than the number of mines or operators is the quantity and metallic content of ore mined. The following tables give details of classes of ore, metal yield in fine ounces of gold and silver to the ton, and gold and silver output by classes of ore and by methods of recovery, embracing all ores that yielded gold and silver in the United States (excluding the Philippine Islands and Puerto Rico) in 1945. These tables were compiled from the individual State chapters in this volume; the chapters contain additional data on the subject.

The classification originally adopted in 1905 on the basis of smelter terminology, smelter settlement contracts, and smelter recovery has been used continuously in succeeding years, except for modifications necessitated by the improvement in recovery of metals and the lowering of grade of complex ores treated, accomplished by improved mill concentration processes. A "dry" ore is one that carries so little lead or copper that by itself it would not satisfy the requirements for the smelter charge in either lead smelting or copper smelting. The copper ores include those smelting ores that contain 2.5 percent dry assay or more of copper (or less than this percentage if no other metal is present), or those ores concentrated chiefly for their copper content. The lead ores are those that contain 5 percent dry assay (minimum lead smelting charge requires 7.5 to 8.5 percent wet assay) or more of lead, irrespective of precious-metal content; an ore that carries any grade of lead exclusively is called a lead ore. Zinc smelting ores (chiefly oxides) range from 16 to 45 percent zinc; zinc concentrating ores include any grade of zinc ore that makes marketable zinc concentrate, irrespective of precious-metal content. The mixed ores are combinations of those enumerated. The smelter classification applies to concentrates.

Ore produced in the United States and average recovery in fine ounces of gold and silver per ton in 1945 [1]

State	Gold ore			Gold-silver ore			Silver ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska	6, 506	1. 599	0. 439						
Arizona	2, 251	. 538	1. 472	6, 784	0. 130	5. 673	10, 471	0. 026	10. 090
California	172, 653	. 272	. 123	490	. 071	2. 573	82	. 024	16. 927
Colorado	432, 028	. 143	. 611	120, 963	. 097	2. 817	74, 532	. 004	7. 565
Idaho	113, 030	. 053	. 420	64	5. 672	111. 938	122, 094	. 001	29. 331
Montana	65, 776	. 223	. 210	67, 867	. 065	4. 666	55, 070	. 019	5. 815
Nevada	183, 302	. 148	. 156	11, 293	. 098	6. 635	8, 172	. 022	6. 997
New Mexico	1, 412	. 555	2. 005	13, 068	. 168	11. 914	3		7. 333
Oregon	1, 258	. 352	. 977				120	. 317	70. 358
South Dakota	312, 612	. 179	. 085						
Texas							1, 093		20. 912
Utah	19, 869	. 511	. 963	56, 001	. 119	4. 259	71, 821	. 037	9. 341
Washington	53, 174	. 332	2. 230						
Wyoming	37	. 054	. 378						
	1, 363, 908	. 186	. 403	276, 530	. 099	4. 244	343, 458	. 013	15. 524
Eastern States	400	. 013	. 003						
	1, 364, 308	. 186	. 403	276, 530	. 099	4. 244	343, 458	. 013	15. 524

See footnotes at end of table.

Ore produced in the United States and average recovery in fine ounces of gold and silver per ton in 1945 [1]—Continued

State	Copper ore			Lead ore			Lead-copper ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska	6	0.500	6.333						
Arizona	30,644,470	.002	.069	21,340	0.020	2.537	2		3.500
California	311,326	.003	.062	26,053	.056	4.099			
Colorado	7,230	.013	3.184	7,229	.150	7.615			
Idaho	8,569	.062	1.047	107,511	.001	4.055	67	0.015	166.299
Montana	4,463,131	.003	1.005	14,919	.056	3.528			
Nevada	4,917,945	.010	.055	12,707	.023	13.148			
New Mexico	6,228,727	(2)	.004	4,627	.037	3.859			
Oregon									
South Dakota									
Texas	1,600		.255						
Utah	23,978,159	.010	.087	24,305	.053	11.531			
Washington	38	.105	5.737	1,800	.001	1,469			
Wyoming				15		1.133			
	70,561,201	.005	.128	220,506	.026	5.317	69	.014	161.580
Eastern States	1,097,730	(2)	.051	(3)	(3)	(3)			
	71,658,931	.005	.127	220,506	.026	5.317	69	.014	161.580

State	Zinc ore			Zinc-lead, zinc-copper, and zinc-lead-copper ores			Total ore		
	Short tons	Average ounces per ton		Short tons	Average ounces per ton		Short tons	Average ounces per ton	
		Gold	Silver		Gold	Silver		Gold	Silver
Western States and Alaska:									
Alaska							6,512	1.598	0.445
Arizona	8,914	0.010	1.593	572,672	0.020	2.146	31,266,904	.002	.114
California	60,105	.071	2.931	147,260	.006	4.445	717,969	.076	1.366
Colorado	151,998	.007	.456	563,571	.030	1.614	1,357,551	.069	1.639
Idaho	[4] 100,039	.001	.744	2,687,912	.003	1.479	3,139,286	.005	2.594
Montana	[5] 87,801	.005	1.325	164,998	.013	3.843	4,919,562	.007	1.208
Nevada	94,029	.005	1.074	147,225	.015	2.310	5,374,673	.015	.193
New Mexico	265,931	(2)	.112	329,559	.006	.715	6,843,327	.001	.068
Oregon							1,378	.349	7.019
South Dakota							312,612	.179	.085
Texas							2,693		8.639
Utah	[6] 104,499	(2)	.069	468,530	.063	5.983	24,723,184	.011	.247
Washington	29,607		.031	883,627	.046	.180	968,246	.060	.291
Wyoming							52	.038	.596
	902,923	.007	.653	5,965,354	.019	1.834	79,633,949	.010	.362
Eastern States	1,942,016			677,927	(2)	.022	[7] 3,718,073	(2)	.019
	2,844,939	.002	.207	6,643,281	.017	1.649	83,352,022	.009	.346

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.
[2] Less than 0.0005 ounce per ton.
[3] A small quantity of lead ore included with zinc-lead ore.
[4] Includes 92,266 tons of old lead-smelter slag.
[5] Includes 25,711 tons of old lead-smelter slag.
[6] Includes 79,413 tons of old lead-smelter slag.
[7] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Gold, gold-silver, and silver ores containing too little copper, lead, or zinc to be classified as copper, lead, zinc, or mixed ores are called "dry" ores regardless of the ratio of concentration, except low-grade ore milled chiefly for its copper content and having very little or no precious-metal content (chiefly, the "porphyry coppers") and ores from which separate products of lead concentrates and zinc concentrates are made. The crude ore into the mill in these two exceptional instances thus takes its name from its products—a name that is also justified by the mineralogical content and final recovery of metals. The "dry ores" thus, by elimination, include ores, chiefly siliceous, valuable for their gold and silver content and, in some instances, for their fluxing properties, regardless of method of treatment. Dry gold ores are those that by inspection are overwhelmingly of gold content; a similar qualification applies to silver ores; decision as to "gold-silver" ore is made on a basis of value, using the rule that the metal of lower value is not used in the bimetal classification unless its value equals or exceeds one-quarter of the combined value of the gold and silver.

The lead, zinc, and zinc-lead ores in most districts in the Eastern and Central States carry no appreciable quantity of gold or silver; such ores are excluded from this report unless otherwise indicated.

Mine production of gold in the United States, 1941–45, by percent from sources and in total fine ounces [1]

Year	Percent from—						Total fine ounces
	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1941	31.3	54.3	11.8	0.5	(2)	2.0	4,750,865
1942	29.3	50.0	17.0	.7	(2)	2.9	3,457,110
1943	11.6	38.3	39.5	1.1	0.3	9.2	1,363,815
1944	12.4	29.8	45.4	.9	.8	10.7	998,394
1945	19.3	29.9	37.5	.6	.7	12.0	954,572

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.1 percent.

Mine production of silver in the United States, 1941–45, by percent from sources and in total fine ounces [1]

Year	Percent from—						Total fine ounces
	Placers	Dry and siliceous ore	Copper ore	Lead ore	Zinc ore	Zinc-lead, zinc-copper, lead-copper, and zinc-lead-copper ores	
1941	0.3	41.2	27.9	5.6	0.3	24.7	67,258,997
1942	.3	37.3	27.8	5.5	1.2	28.0	54,090,765
1943	(2)	26.1	33.7	8.1	1.2	31.0	41,460,826
1944	(2)	17.1	34.4	12.0	2.2	34.3	34,473,540
1945	.1	24.3	31.4	4.4	2.0	37.8	29,024,197

[1] Philippine Islands and Puerto Rico excluded.
[2] Less than 0.1 percent.

Mine production of gold in the United States in 1945, by States and sources, in fine ounces, in terms of recovered metals [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alabama		5						5
Alaska	57,708	10,406	3					68,117
Arizona	540	2,364	62,265	426		89	11,539	77,223
California	93,480	47,030	796	1,462		4,270	900	147,938
Colorado	7,901	73,773	92	1,087		1,018	17,064	100,935
Idaho	1,769	6,414	532	79	1	59	8,926	17,780
Montana	9,690	20,104	11,378	840		438	2,147	44,597
Nevada	9,560	28,453	51,340	287		441	2,184	92,265
New Mexico	15	2,981	557	171		55	1,825	5,604
Oregon	3,986	481						4,467
Pennsylvania			[2] 1,588					1,588
South Dakota		55,948						55,948
Tennessee			148					148
Texas								
Utah		19,429	229,526	1,281		28	29,715	279,979
Vermont			104					104
Virginia							12	12
Washington	14	17,630	4	2			40,210	57,860
Wyoming		2						2
	184,663	285,020	358,333	5,635	1	6,398	114,522	954,572

[1] Philippine Islands and Puerto Rico excluded.
[2] From magnetite-pyrite-chalcopyrite ore.

Mine production of silver in the United States in 1945, by States and sources, in fine ounces, in terms of recovered metals [1]

State	Placers	Dry and siliceous ore	Copper ore	Lead ore	Lead-copper ore	Zinc ore	Zinc-lead, zinc-copper, and zinc-lead-copper ores	Total
Alabama		1						1
Alaska	7,086	2,859	38					9,983
Arizona	45	147,454	2,113,537	54,145	7	14,201	1,228,827	3,558,216
California	6,050	23,884	19,354	106,792		176,164	654,554	986,798
Colorado	1,395	1,168,656	23,017	55,048		69,317	909,347	2,226,780
Idaho	405	3,635,825	8,968	435,979	11,142	74,402	3,975,946	8,142,667
Illinois							2,198	2,198
Michigan			21,863					21,863
Missouri				94,822				94,822
Montana	810	650,746	4,487,436	52,641		116,298	634,139	5,942,070
Nevada	3,811	160,704	270,607	167,075		101,027	340,156	1,043,380
New Mexico	7	158,547	23,460	17,855		29,687	235,571	465,127
New York							14,271	14,271
Oregon	789	9,672						10,461
Pennsylvania			[2] 10,434					10,434
South Dakota		26,564						26,564
Tennessee			35,391					35,391
Texas		22,857	408					23,265
Utah		928,527	2,087,402	280,256		7,208	2,803,152	6,106,545
Vermont			20,586					20,586
Virginia			393				907	1,300
Washington		118,568	218	2,644		911	159,103	281,444
Wyoming		14		17				31
	20,398	7,054,878	9,123,112	1,267,274	11,149	589,215	10,958,171	29,024,197

[1] Philippine Islands and Puerto Rico excluded.
[2] From magnetite-pyrite-chalcopyrite ore.

Gold and silver produced in the United States from ore and old tailings, in 1945, by States and by methods of recovery, in terms of recovered metals [1]

State	Total ore and old tailings, etc., treated (short tons)	Ore and old tailings to amalgamation and cyanidation mills and bullion recovered			Ore and old tailings to concentrating mills (short tons)	Concentrates smelted (from amalgamation and cyanidation and concentrating mills combined)			Crude ore to smelters		
		Short tons	Gold (fine ounces)	Silver (fine ounces)		Short tons	Gold (fine ounces)	Silver (fine ounces)	Short tons	Gold (fine ounces)	Silver (fine ounces)
Western States and Alaska:											
Alaska	6, 512	6, 506	9, 214	1, 660	----------	104	1, 192	1, 199	6	3	38
Arizona	[2] 28, 789, 433	206	29	460	28, 098, 648	1, 013, 484	51, 573	2, 393, 737	[3] 704, 134	25, 081	1, 163, 974
California	717, 969	168, 119	39, 663	11, 462	479, 348	55, 852	11, 476	308, 078	70, 502	3, 319	661, 208
Colorado	1, 357, 551	544, 450	35, 589	18, 856	784, 093	129, 138	55, 182	2, 093, 481	29, 008	2, 263	113, 048
Idaho	3, 139, 286	1, 930	373	203	3, 027, 500	270, 309	14, 136	8, 000, 639	109, 856	1, 502	141, 420
Montana	4, 919, 562	46, 555	7, 947	1, 632	4, 664, 259	422, 070	14, 635	5, 188, 080	183, 037	12, 325	747, 368
Nevada	5, 374, 673	178, 878	20, 789	5, 321	5, 046, 971	241, 910	52, 940	591, 397	148, 824	8, 976	442, 851
New Mexico	6, 843, 327	----------	----------	----------	6, 764, 415	266, 259	2, 407	287, 960	78, 912	3, 182	177, 160
Oregon	1, 378	735	183	46	----------	21	43	869	643	255	8, 757
South Dakota	312, 612	312, 612	55, 948	26, 564	----------	----------	----------	----------	----------	----------	----------
Texas	2, 693	----------	----------	----------	----------	----------	----------	----------	2, 693	----------	23, 265
Utah	24, 723, 184	----------	----------	----------	24, 456, 945	870, 935	259, 077	4, 850, 504	266, 239	20, 902	1, 256, 041
Washington	968, 246	[4] 33, 227	5, 060	27, 907	914, 931	55, 131	50, 872	243, 123	18, 692	1, 914	10, 414
Wyoming	52	----------	----------	----------	----------	----------	----------	----------	52	2	31
	77, 156, 478	1, 293, 218	174, 795	94, 111	74, 237, 110	3, 325, 213	513, 533	23, 959, 067	1, 612, 598	79, 724	4, 745, 575
Eastern States	[5] 3, 718, 073	400	5	1	3, 572, 256	72, 188	1, 852	81, 589	145, 417	----------	393
	80, 874, 551	1, 293, 618	174, 800	94, 112	77, 809, 366	3, 397, 401	515, 385	24, 040, 656	1, 758, 015	79, 724	4, 745, 968

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.
[2] Excludes 2,477,471 tons of copper ore leached from which no gold or silver was recovered.
[3] Includes 13,555 tons of copper precipitates from which silver was recovered.
[4] Includes 774 tons of flotation concentrates cyanided.
[5] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania, on which the Bureau o fMines is not at liberty to publish data.

Gold and silver produced at amalgamation and cyanidation mills in the United States and percentage of gold and silver recovered from all sources, 1941–45 [1]

Year	Bullion and precipitates recovered (fine ounces)				Percent of gold and silver from all sources [1]							
	Amalgamation		Cyanidation		Amalgamation		Cyanidation		Smelting [2]		Placers	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1941	916,113	214,665	1,005,031	5,157,702	19.3	0.3	21.1	7.7	28.3	91.7	31.3	0.3
1942	623,319	140,192	698,817	3,008,490	18.0	.2	20.2	5.6	32.5	93.9	29.3	.3
1943	168,772	44,114	143,092	420,528	12.4	.1	10.5	1.0	65.5	98.9	11.6	(3)
1944	73,974	18,067	76,266	91,009	7.4	(3)	7.6	.3	72.6	99.7	12.4	(3)
1945	85,450	17,024	89,350	77,088	9.0	(3)	9.4	.3	62.3	99.6	19.3	.1

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.
[2] Both crude ores and concentrates.
[3] Less than 0.1 percent.

Gold and silver produced at amalgamation and cyanidation mills in the United States in 1945, by States [1]

State	Amalgamation			Cyanidation			Percent of gold and silver from all sources in State			
	Ore, old tailings, concentrates, etc., treated (short tons)	Bullion recovered (fine ounces)		Ore, old tailings, concentrates, etc., treated (short tons)	Bullion and precipitates recovered (fine ounces)		Amalgamation		Cyanidation	
		Gold	Silver		Gold	Silver	Gold	Silver	Gold	Silver
Western States and Alaska:										
Alaska	6,506	9,214	1,660	------	------	------	13.53	16.63	------	------
Arizona	6	25	5	200	4	455	.03	(2)	0.01	0.01
California	164,003	27,671	4,875	[3] 27,580	11,992	6,587	18.70	.49	8.11	.67
Colorado	197,919	11,386	2,390	[4] 209,888	24,203	16,466	11.28	.11	23.98	.74
Idaho	1,930	373	203	------	------	------	2,10	(2)	------	------
Montana	1,338	200	40	45,217	7,747	1,592	.45	(2)	17.37	.03
Nevada	5,338	1,076	564	173,540	19,713	4,757	1.17	.05	21.37	.46
New Mexico	------	------	------	------	------	------	------	------	------	------
Oregon	669	102	32	66	81	14	2.28	.31	1.81	.13
South Dakota	298,830	35,398	7,254	251,285	20,550	19,310	63.27	27.31	36.73	72.69
Texas	------	------	------	------	------	------	------	------	------	------
Utah	------	------	------	------	------	------	------	------	------	------
Washington	------	------	------	33,227	5,060	27,907	------	------	8.75	9.92
Wyoming	------	------	------	------	------	------	------	------	------	------
	676,539	85,445	17,023	741,003	89,350	77,088	8.95	0.06	9.36	0.27
Eastern States	400	5	1	------	------	------	------	------	------	------
	676,939	85,450	17,024	741,003	89,350	77,088	8.95	0.06	9.36	0.27

[1] Illinois, Michigan, Missouri, Philippine Islands, and Puerto Rico excluded.
[2] Less than 0.005 percent.
[3] Includes 23,464 tons of sands, slimes, and concentrates derived from ore amalgamated, cyanided.
[4] Comprises 131,076 tons of sand and slimes from ore first roasted and amalgamated and 78,812 tons of selective-flotation tailings.

PLACERS

Most of the placer gold output is obtained from gravels handled by connected-bucket floating dredges. In 1945 this method accounted for 84 percent of the total output from placers in the United States compared with 83 percent in 1944 and 69 percent in 1943. The quantity of gold recovered by dredges from the inception of the industry as a commercial factor in 1896 to the end of 1945 is recorded as 19,440,448 ounces, originating by States as follows: California, 11,787,158 ounces; Alaska, 5,237,783 (including the production from single-dipper dredges and some gold by hydraulicking); Montana, 717,425; Idaho, 613,864; Oregon, 470,809; Colorado, 462,491; other States, 150,918.

The following table shows the gold produced in the United States by connected-bucket floating dredges in 1941–45.

Additional information on placer mining may be found in the State reviews in this volume.

Gold produced in the United States by connected-bucket floating dredges, 1941–45, in fine ounces

Year	Dredges	California	Alaska	Other States [1]	Total
1941	123	418,282	307,087	141,636	867,005
1942	102	310,937	249,868	128,264	689,069
1943	21	66,999	18,554	24,373	109,926
1944	17	64,925	26,280	10,774	101,979
1945	36	88,318	34,885	31,269	154,472

[1] Colorado, Idaho, Montana, Nevada, and Oregon.

REFINERY PRODUCTION

The figures in the following table were obtained through cooperation between the United States Bureau of the Mint and the Bureau of Mines and were agreed upon after conference and adjustment between the two Bureaus.

The State totals are based upon bullion deposits in the United States mints and assay offices and upon returns to the Bureau of the Mint from smelting and refining companies. The State distribution is adjusted further by the Bureau of Mines from its geographical records of sources and production, both historical and current, from the producing mines and is tabulated for the mine reports. The data for the total production and in part for the distribution are obtained from records of (1) the unrefined domestic gold and silver deposited in the United States mints and assay offices; (2) the domestic gold and silver in fine bars reported by private refineries, supplemented by data of content of unrefined mattes, blister copper, copper anodes, and lead bullion; and (3) the unrefined domestic gold and silver contained in ore and matte exported for reduction. The last item is small.

Gold and silver produced in the United States, 1941–45, and approximate distribution of source, by States and Territories, in 1945

[Refinery figures supplied by U. S. Bureau of the Mint]

State or Territory	Gold[1]		Silver[2]	
	Fine ounces	Value	Fine ounces	Value
1941	5,976,419	$209,174,600	72,336,029	$51,438,954
1942	3,741,806	130,963,210	56,090,855	39,886,830
1943	1,394,522	48,808,270	40,900,121	29,084,530
1944	1,022,238	35,778,330	35,651,049	25,351,855
1945:				
Alabama	5	175	1	1
Alaska	60,331	2,111,585	8,811	6,266
Arizona	78,246	2,738,610	3,411,405	2,425,888
California	142,794	4,997,790	950,211	675,706
Colorado	101,635	3,557,225	2,406,844	1,711,534
Idaho	18,820	658,700	8,227,758	5,850,850
Illinois			1,546	1,099
Michigan			20,007	14,227
Missouri			20,494	14,574
Montana	42,094	1,473,290	5,493,448	3,906,452
Nevada	90,596	3,170,860	1,155,860	821,945
New Mexico	13,384	468,440	653,893	464,991
New York			14,200	10,098
Oregon	734	25,690	12,352	8,784
Pennsylvania	1,608	56,280	10,530	7,488
South Dakota	41,002	1,435,070	41,191	29,291
Tennessee	148	5,180	35,391	25,167
Texas			20,849	14,826
Utah	270,969	9,483,915	6,244,394	4,440,458
Vermont	102	3,570	20,038	14,249
Virginia	74	2,590	8,505	6,048
Washington	52,857	1,849,995	288,303	205,015
Wyoming	4	140	16	11
	915,403	32,039,105	29,046,047	20,654,968
Philippine Islands	13,490	472,150	17,208	12,237
	928,893	32,511,255	29,063,255	20,667,205

[1] Gold valued at $35 a fine ounce.
[2] Silver valued at $0.711+ a fine ounce.

Gold and silver produced in the United States, 1792–1945 [1]

Period	Gold		Silver	
	Fine ounces	Value[2]	Fine ounces	Value[3]
1792–1847	1,187,170	$24,537,000	309,500	$404,500
1848–1873	60,021,278	1,240,750,000	146,218,600	193,631,500
1874–1945	213,304,188	5,063,186,355	3,744,486,574	2,794,432,671
	274,512,636	6,328,473,355	3,891,014,674	2,988,468,671

[1] From Report of the Director of the Mint. The estimates for 1792–1873 are by R. W. Raymond, Commissioner of Mining Statistics, Treasury Department, and since then, by the Director of the Mint.
[2] Gold valued in 1934 and thereafter at $35 per fine ounce; prior thereto, at $20.67+ per fine ounce. Dollar figures are rounded.
[3] Silver valued in 1934 and thereafter at Government's average buying price for domestic product: In 1934 and 1938, at $0.64+ per fine ounce; in 1935, at $0.71875; in 1936, at $0.7745; in 1937, at $0.7735; in 1939, at $0.678787+, and in 1940–45, at $0.7111+.

CONSUMPTION AND USES IN INDUSTRY AND THE ARTS

Monetary use has claimed by far the largest part of the gold and silver output through the years, but this use to a large extent takes the form of stock-piling in Government and private hoards which are available to industry and the arts without smelter or refinery preparation. In contrast, the gold and silver entering industry and the arts are consumed much as are other metals, any return as secondary metal requiring the usual channels of collection, smelting, and refining. The consumption of gold and silver in the arts antedates written history, but industrial use of these two metals is a recent development.

Gold.—The arts require a much larger quantity of gold than does industry, but its corrosion-resistant and other properties have resulted in some industrial demand. Consumption in the arts increased rapidly during the war. A high war-stimulated marriage rate and widespread prosperity have increased the sale of jewelry, watches, and many luxury items made from gold.

Net industrial consumption of gold and silver in the United States, 1941–45 [1]

Year	Gold (dollars)			Silver (fine ounces)		
	Returned from industrial use	Issued for industrial use	Net industrial consumption	Returned from industrial use	Issued for industrial use	Net industrial consumption
1941	30,975,490	67,977,110	37,001,620	20,361,256	92,793,574	72,432,318
1942	28,447,685	75,742,495	47,294,810	30,020,529	131,419,224	101,398,695
1943	10,521,000	96,864,353	86,343,353	44,112,863	162,112,863	118,000,000
1944	25,678,940	122,977,223	97,298,283	56,189,409	176,289,409	120,100,000
1945	30,991,905	139,936,237	108,944,332	58,360,767	184,660,767	126,300,000

[1] U. S. Bureau of the Mint.

Silver.—The annual consumption for war and other essential uses, based on consumption during the first 6 months of 1945, was estimated to exceed 110,000,000 ounces of silver. In addition, consumption for jewelry and silverware was estimated to be nearly 20,000,000 ounces. Solders and brazing alloys, used extensively in much important military equipment, occupied first place. Following closely for war purposes were photographic applications, electrical appliances, engine bearings, and military insignia. Appreciable quantities continued to be absorbed in making eating utensils for the armed forces, desalination equipment, and dental and medical supplies.

For allocation, the War Production Board divided silver into three classes: Treasury, domestic, and foreign. Treasury silver was eligible for engine bearings, official military insignia, solders and brazing alloys, identification neck chains, and desalination kits. Domestic silver was permitted in silverware, jewelry, watch cases, church articles, pens and pencils, mirrors, and other items classed as nonessential. Foreign silver was limited to photographic uses, electrical appliances, medical and dental supplies, and other items and processes carrying preference ratings.

Prosperity increased the demand for silver as well as gold. Under the Green Act Treasury silver was made available to silversmiths and manufacturing jewelers. The 1945 demand exceeded the current output of domestic mines, and the difference was supplied from the Treasury under the Green Act. The authority to release silver at 71.11+ cents an ounce granted by the Green Act was not renewed when that Act expired December 31, 1945, and silver consumers faced a serious raw-material problem for 1946; the Office of Price Administration ceiling of 71.11+ cents an ounce did not attract foreign silver to the United States market because the foreign price exceeded this level.

Consumption of silver in the arts and industries in the United States, by sources, 1944 and 1945 [1]

Source of silver	Fine ounces	
	1944	1945
Bar payment in exchange for bullion at mints and assay offices	154,196	183,925
Bar sales under Green Act by mints and assay offices [2]	38,287,082	81,560,599
Silver in various forms issued by private refiners and dealers [3]	137,770,787	102,606,868
United States silver coin (estimated)	77,344	309,375
Total	176,289,409	184,660,767
Old jewelry, plate, scrap, etc., returned to private refiners and dealers, and to monetary use	56,189,409	58,360,767
Net new silver used in industry	120,100,000	126,300,000

[1] U. S. Bureau of the Mint.
[2] Excludes silver sold under Green Act for monetary use.
[3] Excludes silver purchased from mints and assay offices under Green Act.

MONETARY STOCKS

Gold holdings of the United States dropped $554,000,000 (3 percent) from $20,619,000,000 on January 1, 1945, to $20,065,000,000 on January 1, 1946, according to the Federal Reserve Bulletin. Total world reserves are not positively known, inasmuch as data are not available from some countries, including the United Kingdom, Germany, Italy, Japan, Australia, and Russia. However, the Federal Reserve System estimates the total at about $35,000,000,000, of which over 57 percent is held by the United States.

Increases in foreign gold reserves have been rapid since the United States entered the war late in 1941, largely because United States war purchases abroad so greatly exceeded commercial exports in value. During this period foreign reserves have increased nearly $5,000,000,000, and United States reserves have declined over $2,500,000,000. Sharing prominently in the increase are Switzerland, Sweden, Turkey, Iran, Spain, South Africa, and the Latin American countries. As a result, many foreign countries entered the postwar period well-supplied with gold, and these reserves promise to be an element of strength in rehabilitating world trade on a peacetime basis.

United States Treasury silver holdings declined 340,000,000 fine ounces during 1945 to 2,005,182,232 ounces. Not included in the holdings are 410,814,344 ounces released under lend-lease agreements that provide for return of the silver.

IMPORTS AND EXPORTS [1]

The large excesses of exports over imports of both gold and silver in 1944 were greatly reduced in 1945. The production of domestic mines replaced only part of the net import-export losses with the result that total stocks of both gold and silver declined.

[1] Figures compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

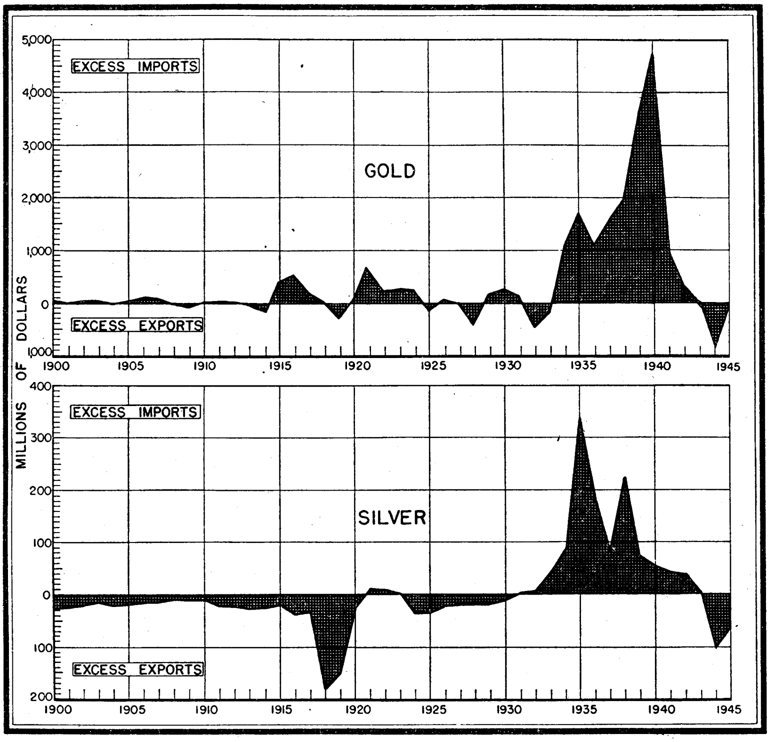

FIGURE 1.—Gold and silver imports and exports, with net movements, 1900–1945.

Value of gold and silver imported into and exported from the United States, 1944–45, by classes

	Imports	Exports	Excess of imports over exports
1944			
Gold:			
Contained in ore and base bullion	$37, 186, 832		$37, 186, 832
Bullion refined	63, 347, 641	$959, 054, 499	[1] 895, 706, 858
United States coin	9, 703		9, 703
Foreign coin	13, 292, 183	173, 424	13, 118, 759
	113, 836, 359	959, 227, 923	[1] 845, 391, 564
Silver:			
Contained in ore and base bullion	16, 567, 093		16, 567, 093
Bullion refined	6, 093, 323	97, 218, 077	[1] 91, 124, 754
United States coin	704, 080	4, 589, 100	[1] 3, 885, 020
Foreign coin	8, 541	25, 108, 167	[1] 25, 099, 626
	23, 373, 037	126, 915, 344	[1] 103, 542, 307
1945			
Gold:			
Contained in ore and base bullion	33, 766, 418		33, 766, 418
Bullion refined	59, 910, 108	198, 270, 054	[1] 138, 359, 946
Foreign coin	41, 524	1, 697, 886	[1] 1, 656, 362
	93, 718, 050	199, 967, 940	[1] 106, 249, 890
Silver:			
Contained in ore and base bullion	16, 166, 198		16, 166, 198
Bullion refined	10, 106, 194	70, 052, 904	[1] 59, 946, 710
United States coin	1, 003, 132	2, 147, 506	[1] 1, 144, 374
Foreign coin	2, 872	18, 736, 491	[1] 18, 733, 619
	27, 278, 396	90, 936, 901	[1] 63, 658, 505

[1] Excess of exports.

PRICES

Since January 1934 the price of gold at the United States Mint has been \$35 per fine troy ounce; the price of domestic silver mined after July 1, 1939, was fixed at \$0.711+ per ounce on July 6, 1939. A complete account of regulations pertaining to gold and silver in 1933–34 is given in the chapter on Gold and Silver in Minerals Yearbook, 1934.

According to the Director of the Mint, the following prices for silver prevailed in London and New York throughout 1944: London price per ounce, 0.925 fine, 23.5 d.; exchange, New York on London, \$4.0350; United States equivalent, per fine ounce, of London price at current rate of exchange, \$0.42713; New York price of fine bar silver, \$0.45062. On January 1, 1945, the price was increased to 25.5 d., a level that was maintained until August, when the price became unsettled. On September 24 the London price was raised to 44.00 d. in response to the increase in the OPA ceiling price for foreign silver in the United States to 71.11+ cents a fine ounce; it remained unchanged until December 31.

Domestic consumers at the beginning of 1945 obtained their silver supplies from sources completely under Government control. Foreign silver at 45 cents an ounce was available for specified uses. Silver released from the Treasury under the Green Act at 71.11+ cents an ounce was also available for purposes approved by the Government. Domestic newly mined silver, which was under an OPA price ceiling of 71.11+ cents an ounce, was distributed on a quota basis for consumption in uses classified as nonessential under WPB Order M–199. The quotas approximated 50 percent of the buyer's consumption in 1941 or 1942, whichever was the larger. With the end of hostilities and the increase in the OPA ceiling price for foreign silver to that for domestic silver, larger supplies became available, but the relaxation of restrictions on use resulted in a continuing scarcity of purchasable silver.

EMPLOYMENT AND LABOR PRODUCTIVITY IN 1944

Data on employment at gold and silver mines are not nearly so comprehensive as those on production. Part of the mines that reported production of gold, gold-silver, and silver ores and placer gold also furnished employment data that could be matched with the production data. These data and the productivity of labor for the years 1941 to 1944 are presented in the following tables. Despite the great fluctuations in gold and silver production during the 4-year period covered, a remarkably narrow range in productivity of labor will be noted, whether measured in tons, metal recovery, or value of product.

Employment and production data for gold and silver lode properties in the United States in 1944, and labor productivity, 1941–44, by kinds of ore mined [1]

	Gold ore	Gold-silver ore	Silver ore
Employment, 1944:			
Average number of men:			
Underground	373	30	89
Surface	159	21	24
Mill	229	18	6
	761	69	119
Man-hours:			
Underground	840,916	49,656	200,594
Surface	333,090	17,536	48,901
Mill	574,359	6,420	14,493
	1,748,365	73,612	263,988
Production, 1944:			
Ore ... short tons	586,053	24,927	52,630
Gold ... fine ounces	107,166	2,800	881
Silver ... do	205,021	129,644	710,134

	Gold ore 1941	1942	1943	1944	Gold-silver ore 1941	1942	1943	1944	Silver ore 1941	1942	1943	1944
Labor productivity, 1941–44:												
Output per man hour:												
Ore ... short tons	0.35	0.41	0.44	0.34	0.25	0.34	0.29	0.34	0.21	0.21	0.22	0.20
Gold ... fine ounces	.055	.069	.056	.061	.028	.032	.018	.038	.003	.003	.002	.003
Silver ... do	.080	.093	.139	.117	1.225	1.243	.903	1.761	3.268	2.855	2.725	2.690
Value gold and silver	$1.98	$2.48	$2.06	$2.29	$1.85	$2.00	$1.27	$2.58	$2.43	$2.14	$2.01	$2.02

[1] Comprises data for only those gold and silver mines for which employment figures were furnished; these properties accounted for 25 percent of the total output of gold and silver ores in 1944.

Employment and production data for gold placer properties in the United States in 1944, by mining methods, and labor productivity, 1941–44, for total placer mining [1]

	Dredging	Hydraulicking	Other methods	Total
Employment, 1944:				
Average number of men	125	12	11	148
Man-hours	344,924	10,065	22,189	377,178
Production, 1944:				
Gold ... fine ounces	46,431	378	353	47,162
Silver ... do	5,376	37	25	5,438

	1941	1942	1943	1944
Labor productivity, 1941–44:				
Output per man-hour:				
Gold ... fine ounces	0.078	0.084	0.078	0.125
Silver ... do	.010	.012	.008	.014
Value gold and silver	$2.74	$2.95	$2.74	$4.38

[1] Comprises data for only those gold placer mines for which employment statistics were furnished; these properties accounted for 38 percent of total output of placer gold in 1944.

WORLD PRODUCTION

World outputs of both gold and silver have declined without interruption since the recent highs established by each metal in 1940. Not only has the trend been downward for both metals, but a review of 1944 and 1945 outputs by countries shows declines in almost every instance. Adverse factors including labor shortages, rising costs, shortage of supplies and equipment, and rising taxes appear to have been world-wide.

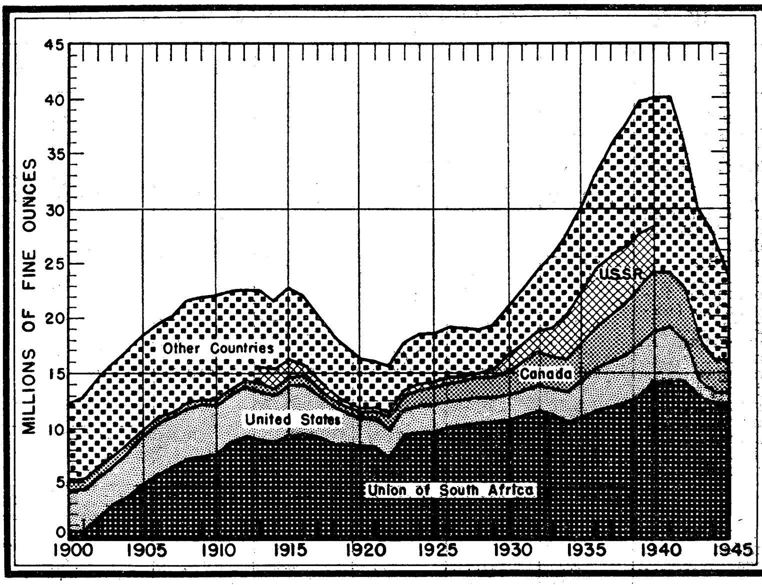

FIGURE 2.—World production of gold, 1900–1945.

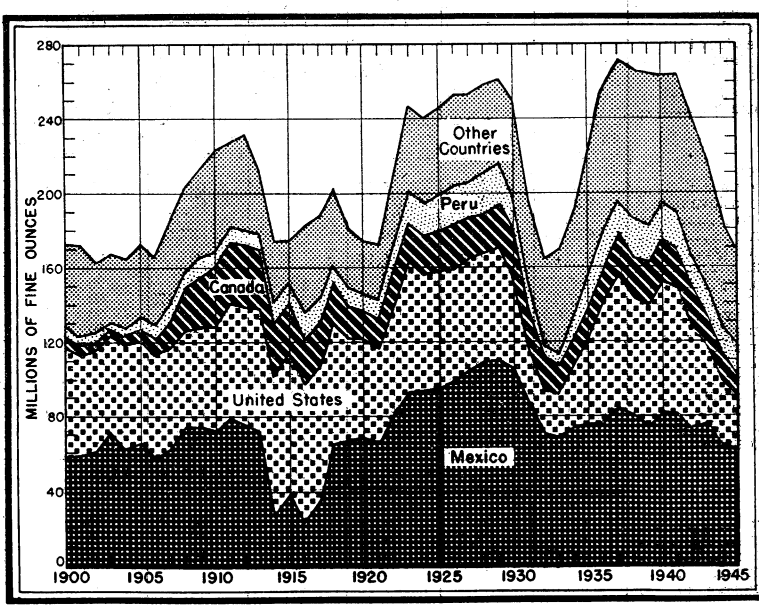

FIGURE 3.—World production of silver, 1900–1945.

World production of gold, 1939–45, by countries, in fine ounces [1]

Country	1939	1940	1941	1942	1943	1944	1945
North America:							
United States (including Alaska and Puerto Rico)[2]	4,620,602	4,862,979	4,832,087	3,583,080	1,380,758	1,022,238	928,893
Canada	5,094,379	5,311,145	5,345,179	4,841,306	3,651,301	2,922,911	2,661,567
Central America and West Indies:							
Costa Rica	[3] 15,863	[3] 16,156	[3] 16,891	[3] 14,864	[3] 6,957	[3] 3,606	[3] 3,054
Cuba	[4] 3,851	[4] 1,251	[4] 607	[4] 195	51	39	[3] 423
Dominican Republic (exports)	6,304	6,914	15,614	6,709	816	683	486
Guatemala	5,058	4,447	2,560	729	409	[3] 126	[3] 66
Haiti	(5)	(5)	(5)	432	310	161	[3] 73
Honduras	[6] 30,600	[6] 37,500	[6] 29,600	[6] 29,084	[6] 20,734	19,774	17,074
Nicaragua (exports)	100,182	168,549	217,771	248,176	223,641	223,910	207,427
Panama	3,774	2,634	2,105	98	----------	----------	----------
Salvador	[3] 16,320	[3] 50,425	[3] 32,856	[3] 31,070	[3] 28,411	[3] 23,204	[3] 9,823
Mexico	841,642	883,117	799,975	801,357	631,537	508,882	449,301
Newfoundland	20,316	21,786	21,194	15,750	18,735	18,329	15,354
	[6] 10,759,400	[6] 11,367,400	[6] 11,316,900	[6] 9,572,900	[6] 5,963,700	[6] 4,743,900	[6] 4,343,500
South America:							
Argentina	12,249	12,860	17,619	20,994	14,467	(5)	(5)
Bolivia	[7] 9,255	[4] 11,749	[4] 8,158	[4] 5,905	[4] 4,304	[4] 4,561	[4] 28,901
Brazil	252,590	264,322	235,390	229,068	[6] 191,300	[6] 178,300	[6] 178,300
Chile	369,474	373,544	278,004	253,590	269,807	243,883	180,462
Colombia	570,017	631,927	656,019	596,618	565,501	553,530	506,695
Ecuador	85,352	71,217	83,375	88,871	90,871	84,234	66,975
Guiana:							
British	38,473	35,745	36,046	29,267	19,470	18,986	22,533
French	37,606	32,561	[4] 34,281	[4] 25,607	[4] 17,726	[4] 18,440	[3] 7,761
Netherlands (Surinam)	14,812	15,921	12,563	7,883	5,795	5,723	5,895
Peru	267,355	281,259	285,189	257,610	199,637	175,180	180,402
Uruguay	1,608	1,762	1,364	(5)	(5)	(5)	(5)
Venezuela	146,608	146,792	99,090	88,150	62,802	59,064	58,397
	[6] 1,804,900	[6] 1,879,600	[6] 1,747,000	[6] 1,603,600	[6] 1,441,500	[6] 1,354,000	[6] 1,246,000
Europe:							
Bulgaria	6,690	7,330	5,562	(5)	(5)	(5)	(5)
Czechoslovakia	[6] 10,000	9,067	(5)	(5)	(5)	(5)	(5)
Finland	1,822	(5)	(5)	2,218	7,137	(5)	5,884
France	[6] 85,000	81,148	59,961	44,336	37,391	16,053	(5)
Germany, Austria	5,029	6,500	5,964	6,610	(5)	(5)	(5)
Hungary	5,079	(5)	(5)	(5)	(5)	(5)	(5)
Italy	7,732	8,632	11,028	12,925	[6] 11,575	(5)	(5)
Norway	[6] 50	(5)	(5)	(5)	(5)	(5)	(5)
Portugal	5,948	[6] 10,000	(5)	(5)	(5)	(5)	(5)
Rumania	153,616	130,286	103,397	83,817	83,270	(5)	(5)
Spain	[6] 30,000	[6] 15,000	(5)	(5)	(5)	(5)	[6] 3,200
Sweden	216,149	208,980	191,297	176,861	135,065	125,259	[6] 73,950
Switzerland	1,447	(5)	(5)	(5)	(5)	(5)	(5)
U. S. S. R.	[6] 5,200,000	(5)	(5)	(5)	(5)	(5)	(5)
United Kingdom	6	----------	----------	----------	----------	----------	----------
Yugoslavia	71,503	[8] 75,000	(5)	(5)	(5)	(5)	(5)
	[6] 5,804,000	[6] 5,377,000	[8] 4,500,000	[8] 4,500,000	[8] 4,500,000	[8] 4,500,000	[6] 3,000,000
Asia:							
Burma	(9)	(9)	(9)	(9)	(9)	(9)	(9)
China	(5)	478,188	(5)	(5)	(5)	(5)	(5)
Manchuria	105,000	100,000	(5)	(5)	(5)	(5)	(5)
Cyprus	[4] 16,393	13,621	[6] 12,500	[6] 4,600	4,165	[6] 1,200	(5)
Formosa (Taiwan)	[6] 145,000	(5)	(5)	(5)	(5)	(5)	(5)
India, British	314,515	289,324	285,938	260,302	252,228	228,000	[6] 170,000
Indochina	8,070	8,038	(5)	(5)	(5)	(5)	(5)
Japan	[6] 836,000	900,000	(5)	(5)	(5)	(5)	(5)
Korea (Chosen)	844,336	947,279	753,027	759,584	490,009	656,678	9,581
Malay States:							
Federated	40,283	35,689	(5)	(5)	(5)	(5)	(5)
Straits Settlements	8	6	(5)	(5)	(5)	(5)	(5)
Unfederated	880	479	(5)	(5)	(5)	(5)	(5)

See footnotes at end of table.

World production of gold, 1939–45, by countries, in fine ounces [1]—Continued

Country	1939	1940	1941	1942	1943	1944	1945
Asia—Continued							
Netherlands Indies	81,183	89,942	(5)	(5)	(5)	(5)	(5)
Philippine Islands	1,040,146	1,140,126	[10] 1,144,332	[10] 158,726	[10] 13,764	(5)	(5)
Sarawak	17,261	12,285	(5)	(5)	(5)	(5)	(5)
Saudi Arabia	15,985	31,965	36,521	31,352	42,643	[4] 8,683	(5)
Thailand (Siam)	12,711	12,717	(5)	(5)	(5)	(5)	(5)
	[6] 3,911,000	[6] 4,383,000	[6] 3,443,000	[8] 1,700,000	[8] 1,600,000	[8] 1,500,000	[6] 500,000
Africa:							
Bechuanaland	17,219	18,015	14,509	15,441	12,966	11,575	11,299
Belgian Congo	522,450	555,404	[11] 561,030	[11] 499,944	[11] 453,300	399,582	381,206
Ruanda and Urundi	29,386	(5)	(11)	(11)	(11)	(11)	(11)
Cameroun, French	14,566	15,760	20,560	20,762	19,625	18,378	17,880
Egypt	3,877	7,344	2,868	1,768	890	1,036	2,014
Eritrea	13,715	11,963	658	5	83	169	[6] 322
French Equatorial Africa	53,868	73,576	88,590	83,856	80,296	74,104	83,669
French West Africa	145,771	126,352	3,955	3,955	5,176	6,237	5,388
Gold Coast	793,099	886,326	885,110	784,478	565,000	534,487	475,407
Kenya Colony	77,444	77,243	72,148	56,771	45,118	42,273	38,517
Liberia	[4] 6,536	[4] 9,661	[4] 20,370	20,700	28,800	18,000	(5)
Madagascar	[6] 14,000	11,580	10,995	8,887	9,183	9,385	(5)
Morocco, French	7,716	4,180	932	32	2,894	2,987	(5)
Nigeria	25,794	25,617	[4] 22,636	[4] 42,410	[4] 19,928	[4] 10,709	(5)
Portuguese East Africa	13,386	13,386	[6] 13,500	(5)	6,481	7,577	(5)
Portuguese West Africa	1,636	2,915	3,896	4,061	1,960	1,270	(5)
Rhodesia:							
Northern	4,645	5,782	3,401	1,134	703	307	(5)
Southern	795,613	826,485	790,442	760,030	656,684	592,729	568,241
Sierra Leone	33,657	32,676	[4] 25,717	[4] 13,174	[4] 3,613	[4] 1,493	(5)
South-West Africa	1,484	1,244	531	231	169	106	(5)
Sudan	7,510	6,606	5,323	5,196	2,127	1,820	1,623
Swaziland	983	1,080	568	1,129	2,734	2,188	(5)
Tanganyika	125,784	143,694	141,550	128,603	69,741	54,868	90,633
Uganda	15,115	11,060	9,505	9,468	3,820	3,055	2,352
Union of South Africa	12,821,507	14,096,502	14,407,649	[12] 14,120,617	[12] 12,800,021	[12] 12,277,228	12,213,545
	[6] 15,547,000	[6] 16,994,000	[6] 17,106,400	[6] 16,591,000	14,791,312	14,071,563	[6] 13,945,000
Oceania:							
Australia:							
Commonwealth [13]	1,645,697	1,643,999	1,496,698	1,153,787	751,279	657,570	[6] 635,000
Papua	36,118	20,845	14,056	(5)	(5)	(5)	(5)
New Guinea, Mandated Territory of	246,214	294,794	[6] 225,000	(5)	(5)	(5)	(5)
Fiji	110,000	111,338	118,681	99,667	90,000	(5)	(5)
New Zealand	178,955	195,665	[6] 190,000	165,987	149,150	142,287	[6] 125,000
	2,216,984	2,266,641	[6] 2,044,000	[6] 1,431,000	[6] 1,000,000	[6] 900,000	[6] 900,000
World total [6]	40,040,000	42,270,000	40,160,000	35,400,000	29,300,000	27,070,000	23,930,000

[1] Preliminary world gold-production table prepared, with revisions and adjustments, by B. B. Waldbauer and S. M. Anderson, Foreign Minerals Division, Bureau of Mines, in cooperation with the Office of the Director of the Mint. Figures used were derived in part from the Statistical Yearbook of the League of Nations and from the American Bureau of Metal Statistics. No official statistics are issued by Government of U. S. S. R., consequently figures released by the various authorities vary widely and are irreconcilable. In some countries accurate figures are not possible to obtain owing to clandestine trade in gold.

[2] Refinery production.

[3] Imports into United States.

[4] Exports.

[5] Data not available. Estimate included in total.

[6] Approximate production.

[7] Purchases by the State Central Bank.

[8] Conjectural figure published by the American Bureau of Metal Statistics (New York), Annual Issue.

[9] Beginning with 1939, Burmese production included with British India.

[10] Figure published by the Director of the Mint, representing gold of Philippine origin refined but not necessarily mined during the year.

[11] Beginning with 1941, production of Ruanda and Urundi included with Belgian Congo.

[12] Exclusive of nonmembers of the Transvaal Chamber of Mines.

[13] Includes New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria and Western Australia.

World production of silver, 1939–45, by countries, in fine ounces [1]

Country	1939	1940	1941	1942	1943	1944	1945
North America:							
United States [3]	63,871,972	68,286,535	71,075,932	55,859,658	40,874,060	35,651,049	29,332,000
Canada	23,163,629	23,833,752	21,754,408	20,695,101	17,344,569	13,627,109	12,866,597
Central America and West Indies:							
Costa Rica [3]	10,292	7,833	11,969	6,119	1,154	3,506	1,380
Cuba	[3] 102,915	[3] 45,836	[3] 27,150	36,238	142,420	[3] 42,985	[3] 107,195
Honduras [3]	4,214,461	3,901,959	3,528,059	3,483,912	3,164,352	3,115,352	3,003,495
Nicaragua (exports)	238,430	256,692	272,574	265,179	251,901	248,529	234,379
Salvador (exports)	116,742	168,541	245,522	191,184	202,064	305,922	212,864
Mexico	75,870,575	82,640,074	78,363,961	84,864,616	76,633,062	65,460,073	61,097,727
Newfoundland	1,421,060	1,494,066	1,657,342	1,106,121	1,258,708	1,163,206	1,076,129
	169,010,000	180,635,000	176,937,000	166,508,000	139,872,000	119,618,000	107,932,000
South America:							
Argentina	4,772,263	3,712,607	2,917,776	2,844,344	(4)	(4)	(4)
Bolivia (exports)	7,241,312	5,626,380	7,348,695	8,121,438	7,299,730	6,797,631	6,683,561
Brazil	27,594	24,694	21,170	25,733	30,048	28,722	(4)
Chile	1,180,902	1,515,563	1,242,240	1,317,058	1,093,543	1,094,894	(4)
Colombia	242,628	260,310	271,115	246,281	209,950	197,323	168,699
Ecuador	104,515	172,292	274,335	261,945	362,013	376,565	255,965
Peru	18,802,075	19,366,096	15,119,047	16,035,022	14,659,742	15,832,440	16,081,833
	[5] 32,371,000	[5] 30,678,000	[5] 27,194,000	[5] 28,852,000	[5] 26,457,000	[5] 26,528,000	25,919,000
Europe:							
Bulgaria (estimated)	[5] 13,000	(4)	(4)	(4)	(4)	(4)	(4)
Czechoslovakia [5]	805,000	870,000	805,000	740,000	740,000	675,000	(4)
Finland	61,086	(4)	(4)	22,570	59,093	(4)	(4)
France	[5] 565,000	393,878	336,264	363,818	482,732	99,731	(4)
Germany / Austria	6,392,918	6,208,469	5,690,939	5,642,455	(4)	(4)	(4)
Greece	[5] 335,000	(4)	(4)	(4)	(4)	(4)	(4)
Hungary	51,600	(4)	(4)	(4)	(4)	(4)	(4)
Italy	686,611	750,045	812,932	(4)	(4)	(4)	(4)
Norway	295,787	282,927	257,206	253,991	231,485	170,399	(4)
Poland	[5] 60,000	(4)	(4)	(4)	(4)	(4)	(4)
Portugal	[5] 16,700	(4)	(4)	(4)	(4)	(4)	(4)
Rumania	712,731	500,204	126,803	89,604	78,994	(4)	(4)
Spain	306,493	1,050,365	455,319	143,714	734,902	778,016	497,800
Sweden	1,122,865	762,487	761,394	985,838	861,640	1,048,114	922,726
U. S. S. R.	[5] 7,000,000	(4)	(4)	(4)	(4)	(4)	(4)
United Kingdom	70,818	81,496	59,669	47,082	33,885	33,742	26,808
Yugoslavia	2,293,634	(4)	(4)	(4)	(4)	(4)	(4)
	[5] 21,785,000	(4)	(4)	(4)	(4)	(4)	(4)
Asia:							
Burma	6,807,200	6,056,700	5,937,000	1,225,000	(4)	(4)	(4)
China	[5] 200,000	(4)	(4)	(4)	(4)	(4)	(4)
Cyprus	[6] 103,953	58,341	(4)	(4)	(4)	[6] 7,611	(4)
Federated Malay States	[5] 3,500	(4)	(4)	(4)	(4)	(4)	(4)
Formosa (Taiwan)	[5] 15,000	(4)	(4)	(4)	(4)	(4)	(4)
Hong Kong	110,000	(4)	(4)	(4)	(4)	(4)	(4)
India, British	22,745	23,298	22,930	20,098	18,611	(4)	(4)
Indochina	1,672	1,736	(4)	(4)	(4)	(4)	(4)
Japan	[5] 10,100,000	13,224,725	13,522,666	13,012,306	6,376,553	5,029,341	(4)
Korea (Chosen)	[5] 2,600,000	(4)	(4)	(4)	(4)	(4)	(4)
Netherlands Indies	618,026	1,506,166	(4)	(4)	(4)	(4)	(4)
Philippine Islands	1,350,099	1,299,199	1,260,097	231,197	26,061	(4)	(4)
Sarawak	700	-----------	-----------	(4)	(4)	(4)	(4)
Saudi Arabia	17,876	37,625	45,315	41,973	47,008	[6] 7,290	(4)
Turkey [7]	575,000	575,000	(4)	(4)	(4)	(4)	(4)
	22,526,000	22,868,000	(4)	(4)	(4)	(4)	(4)
Africa:							
Algeria	113,039	47,614	45,364	18,164	(4)	(4)	(4)
Bechuanaland	813	1,207	949	1,267	1,221	1,319	1,236
Belgian Congo	2,800,000	3,536,582	3,472,280	3,954,541	3,113,478	2,609,226	2,500,000
Gold Coast (exports)	46,403	46,021	36,356	66,580	50,288	56,820	(4)
Kenya Colony	[3] 12,000	13,626	15,643	15,602	16,354	11,500	11,659
Morocco, French	[5] 208,000	(4)	(4)	(4)	(4)	(4)	(4)
Nigeria	[5] 50,000	(4)	(4)	(4)	(4)	1,079	(4)
Portuguese East Africa	2,319	1,901	1,394	907	559	844	(4)

See footnotes at end of table.

World production of silver, 1939–45, by countries, in fine ounces [1]—Continued

Country	1939	1940	1941	1942	1943	1944	1945
Africa—Continued							
Rhodesia:							
Northern	80, 137	312	45, 697	104	41		(4)
Southern	173, 556	186, 080	170, 364	163, 776	119, 322	103, 776	95, 975
Sierra Leone	[6] 1, 300	(4)	(4)	(4)	(4)	(4)	(4)
South-West Africa	558, 290	381, 850					
Tanganyika	28, 004	36, 737	40, 143	25, 087	18, 304	16, 488	(4)
Tunisia	54, 367	41, 056	55, 974	[7] 51, 022	[7] 8, 906	(4)	(4)
Uganda	1, 376	1, 015	1, 005	1, 127	468	(4)	(4)
Union of South Africa	1, 182, 516	1, 292, 284	1, 482, 903	1, 477, 557	1, 334, 042	1, 213, 051	(4)
	[5] 5, 312, 000	[5] 5, 907, 000	[5] 6, 016, 000	[5] 6, 436, 000	[5] 6, 074, 000	(4)	(4)
Oceania:							
Australia:							
Commonwealth [8]	15, 320, 116	15, 871, 976	15, 412, 581	14, 241, 811	10, 329, 830	9, 365, 726	[7] 9, 400, 000
New Guinea, Mandate of	[7] 175, 015	199, 084	[7] 125, 000	46, 284	(4)	(4)	(4)
Fiji	12, 378	23, 020	[7] 30, 382	28, 911	19, 518	9, 619	(4)
New Zealand	390, 342	415, 330	378, 331	311, 360	280, 786	328, 281	(4)
	15, 898, 000	16, 509, 000	15, 946, 000	14, 628, 000	(4)	(4)	(4)
World total [5]	266, 902, 000	275, 387, 000	261, 566, 000	247, 749, 000	217, 041, 000	186, 200, 000	(4)

[1] Preliminary world silver-production table prepared, with revisions and adjustments, by B. B. Waldbauer and S. M. Anderson, Foreign Minerals Division, Bureau of Mines, in cooperation with the Office of the Director of the Mint.
[2] Philippine Islands excluded.
[3] Imports into the United States. Scrap is included in this figure in many instances, most notably in the case of Cuba.
[4] Data not available. Estimate included in total.
[5] Approximate production.
[6] Exports.
[7] American Bureau of Metal Statistics (New York), Annual Issue.
[8] Includes New South Wales, Northern Territory, Queensland, South Australia, Tasmania, Victoria, and West Australia.

REVIEW BY COUNTRIES

CANADA

Gold and silver production in Canada continued to drop in 1945, following a downward trend uninterrupted since 1941 for gold and since 1940 for silver. The gold output for 1945 was less than half that for 1941, the all-time record, and was below that for any year since 1930. Silver output was the lowest since 1920. Output of gold and silver in 1945 was distributed among the several Provinces as follows:

Province:	*Gold, fine ounces*	*Silver, fine ounces*
Alberta	7	1
British Columbia	188, 380	5, 596, 360
Manitoba	66, 903	496, 020
Northwest Territories	8, 737	1, 940
Nova Scotia	3, 378	114
Ontario	1, 590, 339	3, 184, 590
Quebec	664, 226	2, 107, 349
Saskatchewan	109, 000	1, 455, 000
Yukon	30, 597	25, 223
Total	2, 661, 567	12, 866, 597

The downward trend in employment at producing gold mines proceeded with only minor reversals from March 1944 (when 17,788 were employed) to October 1945 (when 14,173 were employed). In November and December the trend was sharply upward; a labor force of 17,621 men was employed in the latter month. Although seasonal fluctuations obscure the trend of employment at nonproducing gold mines, many more men were employed in this field during the latter half of 1945 than during any of the other three 6-month periods since January 1944. These data point to a strong revival of Canadian gold mining both in the expansion of production at prewar mines and in the prospecting and development of new properties.

MEXICO AND CENTRAL AMERICA

Mexico.—Mexico's long record as the world's leading silver producer continued in 1945 despite an uninterrupted decline in output since 1942 due largely to unstable labor conditions and a serious deterioration of rail facilities. Gold output in Mexico experienced a decline paralleling that for silver.

Honduras.—Honduras, the leading silver producer in Central America, derived most of its output in 1945 from the Rosario group near Tegucigalpa. Renewed exploration and development of gold and silver deposits were reported.

Nicaragua.—Nicaragua continued to be the leading gold producer in Central America.

SOUTH AMERICA

Brazil.—Gold output in Brazil in 1945, as for many preceding years, was centered in Minas Gerais, where the St. John d'El Rey Mining Co. was by far the most-important producer.

Chile.—Chilean gold production is derived about equally from gold ores and copper ores. In 1945 there was a marked decrease in output from that in 1944. Punitaqui continued to be the principal lode gold producer. A force of 2,000 workers was reported at the richer gold placers, but an estimated 30,000 men had found relief work at gold placers during periods of economic depression. The Government indicated that it considered gold placers a prime source of jobs for those who will be released as the demand for copper slackens.

Colombia.—Higher operating costs and difficulties in obtaining machinery, particularly dredging equipment for the gold-platinum placers, have proved adverse factors in the Colombian gold industry. Gold output in 1945, however, continued near the level of the past few years.

Peru.—Peru continued to produce over half the silver in South America. The local silversmithing industry based on Inca designs has expanded rapidly since 1941. Wrought silver was exported to Venezuela, the United States, Panama, the Canal Zone, Brazil, and many other countries.

AFRICA

Union of South Africa.—The level of gold output was sustained in the Union of South Africa but declined elsewhere, and consequently the Union accounted for over half the world output in 1945, a condition that had not prevailed since 1930. Rising costs at Rand mines reduced profits and caused the suspension of some operations. A reduction in the scale of operation seemed imminent unless the price of gold increased or the general price and wage level declined. The Government indicated its opposition to a subsidy system that would enable unprofitable mines to continue operations with funds exacted by taxation from profitable properties. The following data prepared by the Transvaal Chamber of Mines compare mining results in 1944 and 1945:

	1944	*1945*
Ore milled (tons)	58, 504, 400	58, 897, 600
Gold recovered (fine ounces)	12, 277, 228	12, 213, 545
Gold recovered dwt. per ton	4. 039	3. 997
Working revenue	£99, 623, 168	£101, 847, 382
Working revenue per ton	34s 1d	34s 7d
Working cost	£66, 681, 942	£69, 941, 061
Working cost per ton	22s 10d	23s 9d
Working cost per ounce	112s 11d	118s 10d
Working profit	£32, 941, 226	£31, 906, 321
Working profit per ton	11s 3d	10s 10d
Dividends	£13, 617, 895	£13, 056, 263

The figures for total gold recovered include 463,499 ounces in 1944 and 443,641 ounces in 1945 from miscellaneous producers not embodied in other data. The dividend figures include intercompany payments; the net dividends were £13,058,422 in 1944 and £12,505,386 in 1945.

During 1945 operation of the Van Ryn Deep Mine, one of the oldest Witwatersrand producers, was suspended indefinitely. Other properties were to be closed at the end of the year. Development on the Far West Rand and in the Orange Free State, however, gave some promise that new producers would be opened there to replace the mines reaching exhaustion in the Johannesburg area. Production was increasing in the Far West Area, and some phenomenally rich assays were reported for diamond drill cores from Orange Free State exploratory work. A huge stock-market boom resulted from the latter developments. The Orange Free State drilling and development work, however, has not advanced to a point where substantial tonnages of ore are blocked out.

ASIA

India.—Gold production in India continued to decline. Reports from the Bawdwin mine in Burma, the leading silver producer of Asia in prewar years, indicated that substantial output would require several years for reestablishing transportation facilities, recruiting a labor force, and rehabilitating the mine and surface plant.

Korea.—The large output of Korean gold mines under Japanese supervision collapsed with the Japanese defeat.

OCEANIA

Australia.—The decline in gold output of the Commonwealth of Australia in progress during the war appeared to have been arrested in 1945. High costs and labor shortages restricted a revival of the industry, however. Although gold production data for New Guinea are not available, this area gives promise of regaining shortly its prominence as a source of gold.

COPPER

By T. H. Miller and Helena M. Meyer

SUMMARY OUTLINE

SUMMARY

Most commodities were subject to widely varying economic conditions during 1945, and copper ranked with those most seriously affected because of its close relationship to the production of armament. In the first quarter of 1945 copper was consumed at a greatly expanded rate, easily representing the record until then, and there was every indication that consumption for all of 1945 would reach a new annual peak. Early in 1945 the opinion was fairly generally held that stated military requirements for copper were excessive to a marked degree. As the spring of 1945 arrived the defeat of German military forces appeared assured, and concern was growing as to the disposition of the surplus of world production over normal world requirements. Plans for defeating Japan called for the use of such large quantities of copper, however, that fears concerning surpluses were said to be premature. High authorities claimed that copper requirements for a one-front war would be only slightly different from those for a two-front conflict. Germany surrendered in May, and the sudden collapse of Japanese resistance in August gave much less time than expected for orderly working out of surplus world-supply problems during the progress of the one-front war. Countries such as Chile, Rhodesia, Belgian Congo, and Canada were gravely concerned with the problems surrounding the disposal of their anticipated surplus production of copper; in the three first-named countries copper exports are the most important source of foreign exchange.

Following Germany's surrender, copper deliveries of duty-free and duty-paid foreign copper for domestic consumption, as reported by the Copper Institute, dropped precipitously; they were 537,000 tons in the first quarter, 394,000 tons in the second, and 259,000 tons in the third and recovered to 328,000 tons in the final quarter of 1945. The first-quarter deliveries constituted a new high record by a substantial margin, the 218,488 tons for March having exceeded the prewar (1935–39) monthly average of nearly 57,000 tons by 283 percent. Only about one-third of the record March total was supplied from domestic sources, the remainder coming from Office of Metals Reserve stocks. Wanders,[1] in discussing the prospective return to peacetime consumption of copper, said:

> After living for several years with astronomical supply and requirement statistics that made sense only to the high command, the industry naturally is anxious to return to earth as soon as possible.

Despite the large demands for copper early in 1945 and the fact that proposed legislation, subsequently enacted into law in June, assured continuation of bonus payments until June 30, 1946, supplies from domestic mines were decreasing gradually. Mine production aggregated 204,000 tons in the first quarter of 1945, 207,000 in the second, 184,000 in the third, and 178,000 in the fourth. Total production in 1945 was 772,894 tons, or 21 percent below 1944 and 29 percent below the record annual rate for 1943. Production in the first quarter of 1945 was 24 percent below that in the first quarter of 1944, contrasted with the behavior of deliveries, which were 40 percent higher in the first quarter of 1945 as compared with the similar period in 1944. Declining production in the face of record requirements is explained in large part by the continuing inability of Government and operators to solve the problems imposed by the shortage of labor and the inefficiency of a segment of the available supply thereof. The failure by a wide margin of domestic mines to supply total needs for copper in the late months of 1945, after hostilities ended, was a promising factor for foreign producers; the United States appeared to require metal from abroad to fill a large pent-up civilian demand.

A War Production Board report on war production in 1944 gave an idea of the dislocation in the copper industry that would result from termination of fighting on both western and eastern fronts. This report stated, among other things, that under the Controlled Materials Plan in 1944 direct military and export requirements had absorbed 90, 69, and 71 percent, respectively, of the brass-mill, wire-mill, and foundry-copper and copper-base alloy products. These percentages showed that the problems involved in changing from a war- to a peace-time economy would be great but that the pent-up civilian demand undoubtedly was enormous.

Most of the Government foreign purchase contracts were terminated, effective October 31. Rumors recurred that producers in copper-exporting nations would be unable to dispose of much of their copper in peacetime world markets, and proposed stock-pile legislation was aimed not only at providing metal to supplement domestic production in case of a subsequent emergency but also at removing from the market possible unmanageable surpluses of metal, alloys, and scrap. Before the end of the year, however, domestic production was lagging far behind consumption, and Government stocks were being depleted. A large portion of the copper in the hands of the Office of Metals Reserve at the end of 1945 was in forms that would not meet all specifications. Moreover, the maintenance of a stock pile was known to be part of the long-range Government policy.

[1] Wanders, H. H., Copper: Immediate Prospects Favor Domestic Producers: Eng. and Min. Jour., vol. 146, No. 7, July 1945, p. 86.

Salient statistics of the copper industry in the United States, 1941–45, in short tons

	1941	1942	1943	1944	1945
New copper produced—					
From domestic ores, as reported by—					
Mines	958,149	1,080,061	1,090,818	972,549	772,894
Ore produced:					
Copper ore	[1] 78,452,504	[1] 92,285,626	[1] 98,119,735	[1] 91,063,648	[1] 76,855,857
Average yield of copper, percent	1.15	1.09	1.04	.99	.93
Smelters	966,072	1,087,991	1,092,939	1,003,379	782,726
Percent of world total	32	35	35	35	33
Refineries	975,408	1,064,792	1,082,079	973,852	775,738
From foreign ores, matte, etc., refinery reports	419,901	349,769	297,184	247,335	332,861
Total new refined, domestic and foreign	1,395,309	1,414,561	1,379,263	1,221,187	1,108,599
Secondary copper recovered from old scrap only	412,699	427,122	427,521	456,710	559,815
Copper content of copper sulfate produced by refiners	6,984	8,076	7,667	8,269	8,237
Total production, new and old and domestic and foreign	1,814,992	1,849,759	1,814,451	1,686,166	1,676,651
Imports (unmanufactured) [2]	735,545	764,393	716,654	785,366	853,196
Refined [2]	346,994	401,436	402,762	492,395	531,367
Exports of metallic copper [3]	158,893	210,518	294,459	237,515	132,545
Refined (ingots, bars, rods, etc.)	114,753	131,732	177,341	69,002	53,572
Stocks at end of year	317,500	319,500	309,500	392,000	461,000
Refined copper	77,500	84,000	68,500	81,000	130,000
Blister and materials in solution	240,000	235,500	241,000	311,000	331,000
Withdrawals from total supply on domestic account:					
Total new copper	1,641,550	1,678,091	1,621,666	1,632,709	1,542,403
Total new and old copper	2,368,000	2,606,000	2,708,000	2,584,000	2,549,000
Price, average ... cents per pound	11.8	[4] 11.8	[4] 11.8	[4] 11.8	[4] 11.8
World smelter production, new copper	[5] 3,000,000	[5] 3,100,000	[5] 3,100,000	[5] 2,900,000	[5] 2,400,000

[1] Includes old tailings.
[2] Data include copper imported for immediate consumption plus material entering country under bond.
[3] Total exports of copper, exclusive of ore, concentrates, composition metal, and unrefined copper. Exclusive also of "Other manufacturers of copper," for which figures of quantity are not recorded.
[4] Exclusive of bonus payments of the Office of Metals Reserve.
[5] Estimated.

On the whole, by the end of the year sentiment had changed, and the consensus seemed to be that prospective postwar world consumption would be large enough to require most of the world's nonsubsidized copper production for a number of years, provided that foreign countries could arrange for financing purchases and that a United States Government stock pile was to be maintained. In consequence of the inadequacy of United States production, the Civilian Production Administration recommended resumption of foreign purchases late in December, when it announced that the gap between production and reconversion requirements had widened to 46,000 tons a month. Announcement of the resumption was made January 29, 1946, when the Reconstruction Finance Corporation indicated that 20,000 tons a month for the first 6 months of 1946, or a total of 120,000 tons, would be bought abroad by the Office of Metals Reserve. A reversal of the recent policy of the British Government, of reducing purchases and depleting stocks on hand, was indicated when it was announced that this nation had contracted for all Rhodesian and Canadian copper not previously committed for the first 6 months of 1946. Early in 1946 the British Government was reported to be negotiating also for Chilean copper.

In meeting the record war demands of early 1945, copper-consuming industries performed some remarkable feats. The brass-mill industry achieved a 400-percent production increase during the war, according to a chart released by the WPB.[2] Brass-mill production reached a record monthly peak of 517,539,000 pounds in March, compared with a peacetime monthly average of about 100,000,000 pounds. March production of copper communication wire increased to a new record total of 267,000 miles,[3] which elicited a tribute from the Army Signal Corps.

The United States benefited from reverse Lend-Lease in regard to copper in 1945. In April the Foreign Economic Administration announced that the British Government made 30,000 tons of Rhodesian copper available in the first quarter of 1945 under reverse Lend-Lease, consequently without cash expenditure, and 42,000 tons would be made available in the second quarter as part of a total of 175,000 tons requested during the remainder of the year. Copper from Cyprus had previously been made available through the same means.

In June 1945 the Navy Department released [4] a statement describing activities in connection with the substitution of steel for brass in cartridge cases. In addition to arriving at a solution of the problem to the point of making steel "functionally equal to and even superior to brass" the Department stated that its investigations had led to many design changes in brass-cartridge cases, as well as opening up new possibilities in the development of more powerful and effective guns. The report stated—

> Had these metallurgists failed in their attempt, it probably would have been virtually impossible to wage a modern war with the supplies of copper, major component of brass, then available in this country.

The fact that there were insufficient supplies of several nonferrous metals to meet expanded war requirements led to revised material specifications for and to substitutions for the metals in question. The possible future effects of such revisions and substitutions were recently discussed. [5] The broad conclusions reached were:

> In each of the nonferrous metals the stress of war has resulted in changes in specifications and in the specifying of materials. Much of it has been constructive and indications are that most of these changes will be retained. Some of the changes, or the restrictions imposed, were not too good. Like the house built on sand, they were soon washed away. The good has been retained and the bad discarded. On the whole the changes have definitely been on the credit side of the ledger; progress has been made.

Salient statistics for 1900 through 1945 are covered by the accompanying table.

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[2] American Metal Market, vol. 52, No. 186, September 29, 1945, p. 2.
[3] American Metal Market, vol. 52, No. 74, April 19, 1945, p. 2.
[4] American Metal Market, vol. 52, No. 106, June 5, 1945, pp. 1 and 2.
[5] Cole, Carter S., Impact of War on Non-Ferrous Specifications: Metal Prog., vol. 48, No. 4, October 1945, pp. 684–692.

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Salient statistics of the copper industry, 1900–45

[All figures in short tons, except price]

Year	Production: Smelter (domestic ores)	Production: Refinery (domestic and foreign ores)	Imports (refined)	Exports (refined)	Apparent consumption of new copper	Quoted price at New York [1] (cents per pound)	World production (smelter)	Production from scrap as metal and in alloys: Old scrap	New scrap	Total
1900	303,059	(2)	(3)	[4] 168,987	178,446	16.55	545,400	(2)	(2)	(2)
1901	301,036	(2)	(3)	[4] 97,125	191,381	16.40	580,200	(2)	(2)	(2)
1902	329,754	(2)	(3)	[4] 177,334	275,844	11.97	610,400	(2)	(2)	(2)
1903	349,022	(2)	(3)	[4] 155,365	263,215	13.62	656,500	(2)	(2)	(2)
1904	406,269	(2)	(3)	[4] 277,275	241,095	13.11	727,200	(2)	(2)	(2)
1905	444,392	(2)	(3)	[4] 267,454	290,503	15.98	785,400	(2)	(2)	(2)
1906	458,903	539,526	(3)	[4] 227,376	343,133	19.77	797,777	(2)	(2)	(2)
1907	434,498	516,258	(3)	[4] 254,465	243,886	20.86	794,705	(2)	(2)	(2)
1908	471,285	568,981	(3)	[4] 330,938	239,978	13.39	820,108	(2)	(2)	(2)
1909	546,476	695,510	(3)	[4] 341,423	344,283	13.11	912,246	(2)	(2)	(2)
1910	540,080	711,019	(3)	[4] 354,158	366,203	12.88	946,135	64,500	30,000	94,500
1911	548,616	716,937	(3)	[4] 393,277	340,877	12.55	980,767	76,000	31,000	107,000
1912	621,634	784,052	(3)	[4] 387,500	387,989	16.48	1,102,516	107,000	30,500	137,500
1913	612,242	807,534	(3)	408,956	406,134	15.52	1,090,637	91,500	45,000	136,500
1914	575,069	766,891	(3)	374,451	350,812	13.31	1,027,054	87,882	40,000	127,882
1915	694,005	817,102	(3)	293,782	568,309	17.47	1,165,454	121,187	75,000	196,187
1916	963,925	1,129,694	4,206	358,308	739,441	28.46	1,518,632	175,000	175,000	350,000
1917	943,060	1,210,897	3,376	515,390	697,415	29.19	1,575,290	194,900	188,500	383,400
1918	954,267	1,197,149	19,044	345,014	830,840	24.68	1,574,264	176,670	176,000	352,670
1919	643,210	885,084	17,569	219,080	457,236	18.90	1,095,696	152,600	134,590	287,190
1920	604,531	763,083	54,372	275,613	526,919	17.50	1,057,200	168,960	143,500	312,460
1921	252,793	475,389	34,625	298,059	305,494	12.65	614,600	131,990	85,310	217,300
1922	475,143	627,758	51,572	326,333	448,317	13.56	952,400	202,800	133,100	335,900
1923	717,500	989,918	80,356	364,690	650,237	14.61	1,341,500	270,900	140,000	410,900
1924	817,125	1,130,038	72,955	504,812	677,371	13.16	1,493,600	266,200	122,100	388,300
1925	837,435	1,102,287	49,887	484,033	700,506	14.16	1,546,500	291,010	129,200	420,210
1926	869,811	1,161,243	85,283	428,062	785,068	13.93	1,608,300	337,300	142,500	479,800
1927	842,020	1,162,882	51,640	461,233	711,480	13.05	1,673,300	339,400	150,800	490,200
1928	912,950	1,243,804	42,365	474,737	804,269	14.68	1,880,500	365,500	170,900	536,400
1929	1,001,432	1,370,056	67,007	411,227	889,293	18.23	2,098,800	404,350	222,200	626,550
1930	697,195	1,078,530	43,105	297,057	632,509	13.11	1,760,000	342,200	125,000	467,200
1931	521,356	750,721	87,225	202,698	451,032	8.24	1,536,000	261,300	85,700	347,000
1932	272,005	340,434	83,897	110,977	259,602	5.67	1,027,000	180,980	67,200	248,180
1933	225,000	370,789	5,432	124,582	339,350	7.15	1,143,000	260,300	77,800	338,100
1934	244,227	445,360	27,417	262,366	322,638	8.53	1,448,000	310,900	66,500	377,400
1935	381,294	588,805	18,071	260,735	441,371	8.76	1,681,000	361,700	87,200	448,900
1936	611,410	822,489	4,782	220,390	656,179	9.58	1,895,000	382,700	101,900	484,600
1937	834,661	1,066,814	7,487	295,064	694,906	13.27	2,585,000	408,900	123,200	532,100
1938	562,328	792,416	1,802	370,545	406,994	10.10	2,254,000	267,300	92,500	359,800
1939	712,675	1,009,515	16,264	372,777	714,873	11.07	2,396,000	286,900	212,800	499,700
1940	909,084	1,313,556	68,337	356,431	1,008,785	11.40	2,757,000	333,890	198,156	532,046
1941	966,072	1,395,309	346,994	103,602	1,641,550	11.87	[5] 3,000,000	412,699	313,697	726,396
1942	1,087,991	1,414,561	401,436	131,406	1,678,091	11.87	[5] 3,100,000	427,122	500,633	927,755
1943	1,092,939	1,379,263	402,762	175,859	1,621,666	11.87	[5] 3,100,000	427,521	658,526	1,086,047
1944	1,003,379	1,221,187	492,395	68,373	1,632,709	11.87	[5] 2,900,000	456,710	494,232	950,942
1945	782,726	1,108,599	531,367	48,563	1,542,403	11.87	[5] 2,400,000	559,815	446,701	1,006,516

[1] American Metal Market price for electrolytic copper in New York; f. o. b. refinery through August 1927, New York refinery equivalent thereafter.

[2] Data not available.

[3] Data not separately recorded.

[4] Includes plates and old.

[5] Estimated.

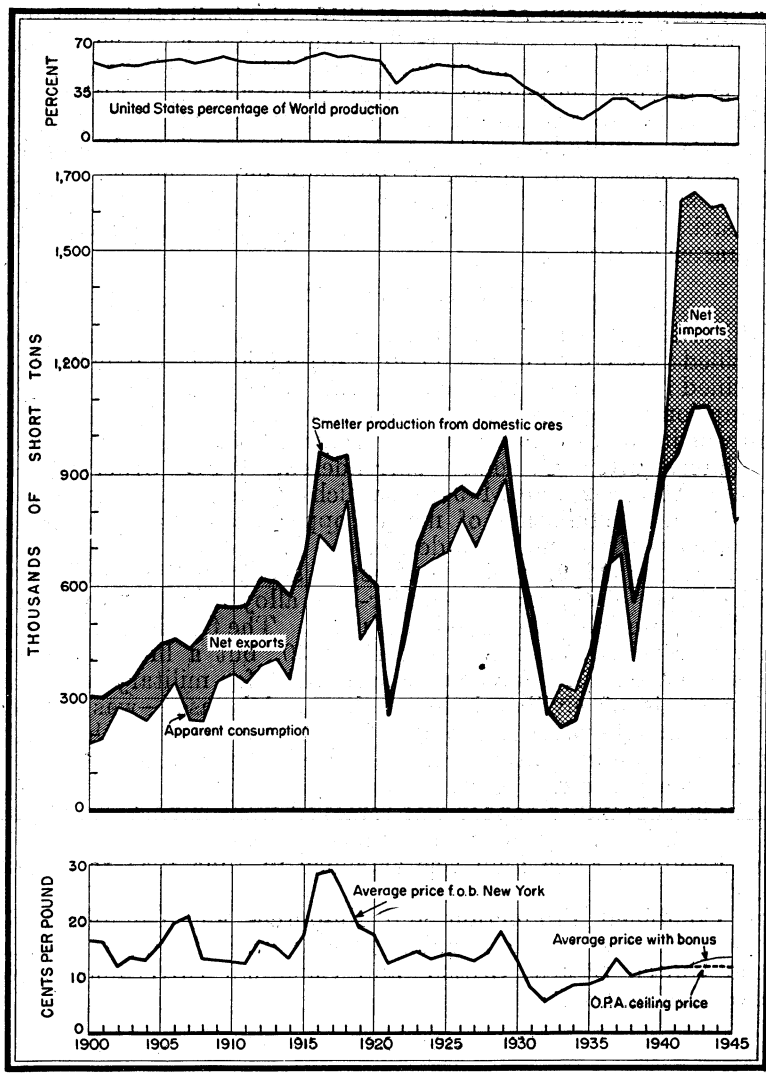

FIGURE 1.—Trends in production, consumption, and price of copper in the United States, 1900–1945.

LABOR PROBLEMS

The labor shortages and inefficiencies that plagued the copper industry in 1944 and earlier war years, described in the chapter on Copper in Minerals Yearbook, 1944, continued unabated in 1945. The stage was set in the final quarter of 1945 for reconversion of the copper industry to a peacetime basis. Reconversion, however, was delayed by a series of conflicts between management and labor concerning wages, bonuses, and other matters; and the problems affected major copper-consuming industries, such as the automobile industry, as well as the copper producing and fabricating industries. The labor problems present at the end of 1945, which affected many industries, appeared to require over-all consideration, and the President called representatives of management and labor to a joint conference aimed at solving the general problems in November. Although the meetings failed to find the constructive solutions desired, they were said to have resulted in better mutual understanding of the diverse viewpoints held. Any optimism that may have been felt regarding the labor situation late in 1945, however, was quickly dispelled when many strikes affecting the copper industry were called during the first quarter of 1946.

WAR AGENCY REGULATIONS

WPB orders that restricted the acceptance of delivery and the use of specified types of copper and copper-base alloys in the manufacture of specified items were discussed in earlier reports of this series. With consumption of copper at a new high rate early in 1945, Government action was in the direction of more stringent controls; but on May 11, immediately after Germany surrendered, WPB Orders M–9–c, M–9–c–1, M–9–c–2, and M–9–c–4, which restricted the manufacture, delivery, and installation of many copper products were revoked. In June copper was not included in the WPB list of items in short supply. Order M–9, which restricted acceptance of delivery of specified types of copper and copper-base alloy materials (other than controlled materials), was lifted in August. The Controlled Materials Plan was revoked, effective September 30, but a limited series of ratings—that is, AAA for emergencies, MM for military needs, and CC for needs of civilian industry in special cases—was retained. The WPB was dissolved November 3, and a new agency, the Civilian Production Administration, was assigned the task of converting industry to a peacetime basis.

Early in September copper was removed from import control by a revision of Order M–63 (General Import Order).

The Premium Price Plan was extended in June 1945 to June 30, 1946.

The Combined Production and Resources and Combined Raw Materials Boards, which handled various critical supply questions for the United States, British, and Canadian Governments, were dissolved December 31.

STOCK-PILE LEGISLATION

The report of this series for 1944 described the Surplus Property Act briefly. Through the provisions of the act the threat that surplus copper from Government contract cancellations would be dumped on the market was removed. The act, however, was a temporary measure only. Several permanent stock-pile bills were introduced in Congress in 1945, but none had become law by the end of the year. The mineral industry, in general, approved the principal of stock piling, as stated by Conover,[6] but it wanted assurance that the stock pile of strategic metals would not be used to the detriment of domestic producers. The Surplus Property Administrator extended the

[6] Conover, Julian D., Actual Dumping of Surplus Metals Would Do Less Harm Than Overhanging Threat of Sale: Metals, vol. 16, No. 5, November 1945, p. 6.

expiration date of his Administration's stock-piling regulations pertaining to materials believed to be acceptable for permanent stock piling from January 3 to April 1, 1946, pending enactment of legislation for permanent stock piles.

RECIPROCAL TRADE AGREEMENTS ACT

In June 1945 the Reciprocal Trade Agreements Act was renewed for 3 years. This act gives the President authority to cut rates of duty 50 percent below the January 1, 1945, level. The 4-cent tax on imports of copper is classed as an excise tax rather than a tariff but is subject to the terms of the Trade Agreements Act nonetheless. Briefs opposing extension of the act were filed by some of the large copper-producing companies and by the brass-mill industry. These briefs were published in Metals.[7]

UNITED STATES AND UNITED KINGDOM OPINION ON MINERAL POLICY

The report of this series for 1944 stated that postwar surplus world-production capacity over the prewar rate of consumption might call for international cooperative action. The United States and United Kingdom Governments have held conflicting views regarding cartels in the past, with cartel activity prohibited in the United States by the Sherman Antitrust Act. Recently Leith [8] informally and unofficially canvassed the views of nearly 100 mineral specialists, representing 20 minerals, from within Government, industry, and professional fields. The report, he said, was something of a composite of the many views presented but should not be regarded as committing all who were consulted. The recommendations given in the report were as follows:

(1) Freedom and equality of access to the world's mineral supplies. This to include protection of legitimate foreign investments, and the right to repatriate capital.

(2) Freedom of international trade and reduction of trade barriers, including the lowering of some of our own mineral tariffs.

(3) Stock-piling of strategic minerals for security purposes. This should be mainly from foreign sources and not used as a means of subsidizing marginal domestic production. So far as public aid may be necessary to develop processes and projects for low-grade materials, this to be covered by other legislation. Foreign purchase for stock piles may also serve as a stabilizing measure to aid in minimizing the anticonservational effects of excessive swings in production and price and to support the exchange position of producing countries.

(4) Possible use of buffer stocks or commodity pools accumulated by international cartels as a stabilizing influence to supplement stock-piling.

(5) Participation in mineral sanctions against warlike nations.

(6) Provisions for international fact finding.

(7) The right of American industry to participate in international cooperative arrangements and cartels in the interest of conservational production and of an orderly flow of minerals between the nations. This to be coupled with the necessary international political control, on a policy level, where the public interest is affected. Conservation to be the primary criterion.

(8) Early establishment of the necessary administrative machinery to accomplish these results.

In the House of Lords in March, in a debate on cartels, Lord Geddes,[9] chairman of the Rhokana Corp. group and deputy chairman of Nchanga Consolidated, admitted that Rhodesian copper producers

[7] Metals, vol. 15, No. 11, May 1945, pp. 9–11 and 12–13.
[8] Leith, C. K., Principals of Foreign Mineral Policy of the United States: Min. and Met., vol. 27, No. 469, January 1946, pp. 6–17.
[9] Metals, vol. 15, No. 10, April 1945, p. 15.

acted as a combination and pointed out that, as a result of their work, he was able to tell Neville Chamberlain in 1939 that they were able to meet the requirements of the war, at a time when the United States was not supplying anything to the belligerents. He said they weathered the greatest economic storm the world ever saw, while still developing, and indulged in the practice of price fixation and the limitation of output because, if they had competed with one another, they would have destroyed each other. He added:

> We told the British Government what we were doing. Do you suppose that we as responsible men would have acted for one moment contrary to the wishes of the British Government? No. Do you imagine we were ever denied information as to what the wishes of the British Government were? No. * * * The industries with which I am associated have absolutely no objection to the fullest information being at the Government's disposal at all times.

GEOLOGICAL SURVEY AND BUREAU OF MINES ACTIVITIES

The Geological Survey [10] program of investigation of copper deposits continued throughout 1945 on about the same scale as in 1944. The emphasis of the work continued to shift gradually from studies of individual mines and parts of mining districts, made during the war to aid production, to more comprehensive studies of larger mineralized regions.

Field studies were completed or practically completed during 1945 of the Bagdad mine and vicinity, Yavapai County, Ariz.; of the Empire mine and vicinity, Custer County, Idaho; of the copper-zinc deposits of the California Foothill Copper belt; and of some of the active mines of the Michigan copper district. Investigations undertaken before 1945 were still in progress at the end of the year of the copper-cobalt deposits, Blackbird district, Lemhi County, Idaho, and of Arizona copper deposits in the Globe-Miami districts, Gila County, the Dragoon-Johnson districts, Cochise County, and the San Manuel deposit, Pinal County. New investigations of large mineralized regions were begun during the year in the Jerome-Prescott area, Yavapai County, Ariz., and in Shasta County, Calif.

Preliminary geologic maps were released for public distribution of the Quail Hill, North Keystone, and American Eagle-Blue Moon mines in the Foothill Copper belt in California and of the San Manuel prospect in Arizona. Exploration of the San Manuel prospect was undertaken in 1943 as a cooperative project of the Geological Survey and the Bureau of Mines, and drilling during 1945 was continued by private interests. The deposit contains a large tonnage of low-grade copper ore and promises to be one of the most important discoveries in recent years in Arizona.

Preliminary reports were placed in the open files in 1945 of the Penn mine, California, the Charlemont-Heath copper-pyrite deposits, Massachusetts, the Moffet-Johnston mine, Montana, the Arlington and Pahaquarry mines, New Jersey, the San Pedro and Carnahan mines, New Mexico, and the Allamoore-Van Horn district, Texas.

Reports on copper deposits in Alaska, released during the year, described the Spirit Mountain nickel-copper prospect in the Copper River region and the Salt Chuck copper-palladium deposit on Prince of Wales Island.

[10] Information supplied by G. H. Espenshade

The Geological Survey under the sponsorship of the United States Department of State investigated in 1945 several copper deposits in Mexico in cooperation with the Comite Directivo para la Investigación de los Recursos Minerales de Mexico.

The Bureau of Mines continued its copper-exploration projects in 1945, and war minerals reports describing the results were issued for limited distribution among officials of the United States Government.

DOMESTIC PRODUCTION

Statistics on copper production may be compiled upon a mine, smelter, or refinery basis. Mine data are most accurate for showing the geographic distribution of production; smelter figures are better than mine figures for showing the actual recovery of metal and more accurate than refinery figures for showing the source of production; and refinery statistics are best for showing metal recovery but indicate only in a general way the source of crude materials treated. The chapter on Copper in Mineral Resources of the United States, 1930, part I, discusses the differences among the three sets of figures.

For detailed information by States, districts, and mines, the reader is referred to the various State chapters on gold, silver, copper, lead, and zinc.

Copper produced from domestic ores, as reported by mines, smelters, and refineries, 1941–45, in short tons

Year	Mine	Smelter	Refinery
1941	958,149	966,072	975,408
1942	1,080,061	1,087,991	1,064,792
1943	1,090,818	1,092,939	1,082,079
1944	972,549	1,003,379	973,852
1945	772,894	782,726	775,738

PRIMARY COPPER

Smelter production.—The recovery of copper by smelters in the United States from ores of domestic origin totaled 782,726 short tons in 1945, a decline of 22 percent from the total of 1,003,379 for 1944. Domestic smelter output constituted 51 percent of the world production during 1925–29 but dropped sharply in the succeeding years until 1934, when it was only 17 percent. From 1936 to 1940 it fluctuated between 25 and 33 percent, in 1942–44 it is believed to have been slightly above 35 percent, and in 1945 it dropped to about 33 percent.

The figures for smelter production are based upon returns from all smelters handling copper-bearing materials produced in the United States. For Michigan the sum of furnace-refined copper and copper cast into anodes for electrolytic refining is included. The figures for blister copper represent the fine-copper content. Some casting and electrolytic copper produced direct from ore or matte is included in the smelter production. Metallic and cement copper recovered by leaching is included in smelter production.

The precise quantity, in pounds, of copper produced by smelters in the United States and its value are shown by years for 1845–1930 in the Copper chapter of Mineral Resources of the United States, 1930, part I.

Copper produced (smelter output) in the United States, 1941–45, and total, 1845–1945

[Values rounded]

Year	Short tons	Value
1941	966,072	$227,993,000
1942	1,087,991	[1] 256,766,000
1943	1,092,939	[1] 257,934,000
1944	1,003,379	[1] 236,797,000
1945	782,726	[1] 184,723,000
Total, 1845–1945	32,431,585	9,416,233,000

[1] Excludes bonus payments of Office of Metals Reserve.

In 1945 the Bureau of Mines discontinued the compilation of smelter data by States of origin, because there was insufficient difference between smelter and mine figures to justify the work involved.

Mine production of recoverable copper in the United States, 1941–45, and total smelter output 1845–1945, by States, in short tons

State	1941	1942	1943	1944	1945	1845–1945 smelter output [1]	
						Total quantity	Percent of total
Western States and Alaska:							
Alaska	72	22	27	2	5	676,856	2.09
Arizona	326,317	393,387	403,181	358,303	287,203	10,856,068	33.48
California	3,943	1,058	8,762	12,721	6,473	603,682	1.86
Colorado	6,748	1,102	1,028	1,048	1,485	276,640	.85
Idaho	3,621	3,430	2,324	1,688	1,548	100,698	.31
Montana	128,036	141,194	134,525	118,190	88,506	6,567,879	20.26
Nevada	78,911	83,663	71,068	61,232	52,595	1,722,168	5.31
New Mexico	73,478	80,100	76,163	69,730	56,571	1,295,543	4.00
Oregon	83	103	6	3	1	11,669	.04
South Dakota	---------	1	---------	1	---------	(2)	(2)
Texas	6	99	81	115	55	(2)	(2)
Utah	266,838	306,691	323,989	282,575	226,376	4,839,468	14.93
Washington	8,686	8,030	7,315	6,169	5,821	76,596	.24
Wyoming	4	---------	---------	---------	---------	15,871	.05
	896,743	1,018,880	1,028,469	911,777	726,639	(3)	(3)
Central States:							
Michigan	46,440	45,679	46,764	42,421	30,401	4,803,088	14.81
Missouri	1,400	1,300	1,340	3,302	3,399	(2)	(2)
	47,840	46,979	48,104	45,723	33,800	(3)	(3)
Eastern States:							
Georgia	---------	---------	---------	---------	---------	(2)	(2)
North Carolina	(4)	(4)	(4)	(4)	---------	(2)	(2)
Pennsylvania	(4)	(4)	(4)	(4)	(5)	(2)	(2)
South Carolina	(6)	(6)	(6)	---------	---------	(2)	(2)
Tennessee	[4] 13,566	[4] 14,174	[4] 13,855	[4] 12,860	[5] 12,385	[7] 259,508	[7] .80
Vermont	---------	---------	290	1,898	(5)	(2)	(2)
Virginia	---------	28	100	291	70	(2)	(2)
	13,566	14,202	14,245	15,049	12,455	(3)	(3)
Undistributed	---------	---------	---------	---------	---------	[8] 316,019	[8] .97
	958,149	1,080,061	1,090,818	972,549	772,894	32,421,753	100.00

[1] Mine figures added for 1945.
[2] Included under "Undistributed"; figures not separately recorded.
[3] Data not available.
[4] North Carolina and Pennsylvania included under Tennessee. Bureau of Mines not at liberty to publish separate figures.
[5] Pennsylvania and Vermont included under Tennessee. Bureau of Mines not at liberty to publish separate figures.
[6] Less than 1 ton.
[7] Approximate production through 1928. Figures for 1929–45 confidential and included under "Undistributed."
[8] Includes Tennessee for 1929–45.

Mine production.—The figures for mine production are based upon reports supplied to the Bureau of Mines by all domestic mines that produce copper. Details of the method of collecting the statistics and reasons for the discrepancy between mine-, smelter-, and refinery-production figures are given in the Copper chapter of Mineral Resources of the United States, 1930, part I.

Mine production is more accurate than either refinery or smelter production for showing the distribution of domestic output by States and districts. It also indicates the production by calendar years more exactly, because additional time is required for smelting and refining. Mine production in 1945 was 772,894 tons—a decrease of 21 percent from that in 1944 but 24 percent above the average for 1935–39.

Mine production of copper in the principal districts [1] of the United States, 1941–45, in terms of recovered copper, in short tons

District or region	State	1941	1942	1943	1944	1945
West Mountain (Bingham)	Utah	264, 705	304, 687	322, 248	281, 100	224, 284
Copper Mountain (Morenci)	Arizona	13, 879	60, 356	84, 347	106, 926	100, 826
Summit Valley (Butte)	Montana	127, 431	140, 349	133, 569	117, 363	87, 948
Globe-Miami	Arizona	82, 419	94, 265	100, 513	95, 305	78, 646
Central (including Santa Rita)	New Mexico	67, 727	72, 724	70, 628	65, 520	[2] 55, 197
Robinson (Ely)	Nevada	67, 171	75, 063	64, 090	54, 651	49, 175
Ajo	Arizona	65, 880	66, 647	70, 069	46, 250	37, 950
Lake Superior	Michigan	46, 440	45, 679	46, 764	42, 421	30, 401
Yavapai County (mostly Verde (Jerome) district).	Arizona	43, 701	44, 941	38, 386	32, 273	24, 903
Mineral Creek (Ray)	do	42, 400	50, 362	37, 434	27, 452	19, 671
Warren (Bisbee)	do	56, 592	53, 278	50, 786	32, 683	12, 567
Pioneer (Superior)	do	19, 119	20, 701	18, 820	12, 722	8, 365
Chelan Lake	Washington	8, 365	7, 955	7, 219	6, 119	5, 803
Flat Creek	California	59		670	1, 292	1, 843
Klamath River	do		2	5, 067	7, 891	1, 526
Lordsburg	New Mexico	3, 734	3, 358	2, 496	2, 359	1, 146
Copperopolis	California	1	264	1, 930	2, 122	1, 123
Coeur d'Alene	Idaho	2, 979	2, 993	1, 987	1, 289	1, 018
San Juan Mountains	Colorado	705	539	554	512	1, 018
Tintic	Utah	1, 042	853	841	533	459
Red Cliff (Battle Mountain)	Colorado	5, 609	323	115	55	8
Burro Mountain	New Mexico	1, 144	3, 656	2, 094	1, 261	(2)
Plumas County	California	3, 644		7		
Swain County	North Carolina	(4)	(4)	(4)	(4)	
Cope [3]	Nevada	10, 756	7, 074	5, 133	(4)	(4)
Lebanon (Cornwall mine) [3]	Pennsylvania	(4)	(4)	(4)	(4)	(4)
Ducktown [3]	Tennessee	(4)	(4)	(4)	(4)	(4)

[1] Districts producing 1,000 short tons or more in any year of the period 1941–45.
[2] Burro Mountain included with Central. Bureau of Mines not at liberty to publish separate figures.
[3] Not listed in order of output.
[4] Bureau of Mines not at liberty to publish figures.

Quantity and estimated recoverable content of copper-bearing ores.—The following tables list the quantity and estimated recoverable copper content of the ore produced by mines in the United States in 1944; complete details for 1945 are not yet available. Of the total copper produced from copper ores in the United States during 1944, 90 percent was obtained from ores concentrated before smelting, nearly 7 percent from direct smelting ores, and 3 percent from ore treated by straight leaching. The percentages for 1944 compared with 88 percent obtained from concentrated ore, 8 percent from direct smelting ores, and 4 percent by straight leaching in 1943.

Close agreement between the output as reported by smelters and the recoverable quantity as reported by mines indicates that the estimated recoverable tenor is close to the actual recovery. Classification of some of the complex western ores is difficult and more or less arbitrary. "Copper ores" include not only all those that contain 2.5 percent or more recoverable copper but also those that contain less than this percentage if they are valuable chiefly for copper. Mines report considerable copper from ores mined primarily for other metals. These include siliceous gold and silver ores, lead and zinc ores, and pyritic ores.

Copper ore, old tailings, etc., sold or treated in the United States in 1944, with copper, gold, and silver content in terms of recovered metals

State	Ore, old tailings, etc., sold or treated (short tons)	Copper produced		Gold produced (fine ounces)	Silver produced (fine ounces)	Value of gold and silver per ton of ore
		Pounds	Percent			
Arizona	35, 288, 865	[1] 688, 135, 150	0. 98	91, 113	[2] 3, 106, 107	$0. 15
California	556, 378	[1] 20, 904, 500	1. 88	3, 399	24, 411	. 25
Colorado	7, 880	431, 814	2. 74	91	27, 286	2. 87
Idaho	3, 232	236, 024	3. 65	236	3, 854	3. 40
Michigan	5, 410, 238	84, 842, 000	. 78		54, 218	. 01
Montana	5, 340, 862	[1] 229, 470, 837	2. 15	13, 183	5, 515, 268	. 82
Nevada	6, 181, 967	[1] 112, 768, 800	. 91	54, 593	348, 267	. 35
New Mexico	7, 207, 554	[1] 113, 755, 065	. 79	2, 543	115, 261	. 02
Texas	3, 799	224, 335	2. 95		1, 269	. 24
Utah	29, 930, 659	[1] 523, 678, 541	. 87	286, 013	2, 565, 851	. 40
Washington	36	13, 800	19. 17	4	322	10. 25
Eastern States	1, 132, 178	[3] 29, 784, 000		343	67, 192	
	91, 063, 648	[3] 1, 804, 264, 866	. 99	451, 518	11, 829, 306	. 27

[1] Excludes copper recovered from precipitates as follows: Arizona, 21,211,424; California, 61,100; Montana, 4,713,664; Nevada, 9,245,700; New Mexico, 23,936,645; and Utah, 35,936,977 pounds.
[2] Excludes 295 ounces of silver from precipitates.
[3] Copper from magnetite-pyrite-chalcopyrite ore from Pennsylvania included with that from copper ore.

Copper ore, old tailings, etc., concentrated in the United States in 1944, with content in terms of recovered copper

State	Ore, old tailings, etc., concentrated (short tons)	Concentrates produced (short tons)	Copper produced (pounds)	Copper from ore, etc. (percent)
Arizona	[1] 31, 069, 798	1, 104, 600	[2] 532, 587, 923	0. 86
California	547, 281	52, 330	20, 078, 000	1. 83
Idaho	500	38	17, 824	1. 78
Michigan	5, 410, 238	64, 823	84, 842, 000	. 78
Montana	5, 272, 359	484, 059	224, 585, 124	2. 13
Nevada	6, 055, 651	224, 585	103, 130, 100	. 85
New Mexico	7, 120, 423	224, 475	111, 525, 874	. 78
Utah	29, 927, 992	817, 794	523, 311, 107	. 87
Eastern States	988, 610	[3] 81, 360	[4] 28, 313, 400	
	86, 392, 852	[3] 3, 054, 064	[4] 1, 628, 391, 352	. 94

[1] In addition, 3,131,360 tons were treated by straight leaching.
[2] In addition, 57,792,057 pounds of copper were recovered by straight leaching.
[3] Includes concentrates from magnetite-pyrite-chalcopyrite ore from Pennsylvania.
[4] Includes copper from magnetite-pyrite-chalcopyrite ore from Pennsylvania.

Copper ore, old tailings, etc., smelted in the United States in 1944, with content in terms of recovered copper, and copper produced from all sources, in terms of recovered copper

State	Ore, old tailings, etc., smelted			Copper from all sources, including old slags, smelter cleanings, and precipitates (pounds)
	Short tons	Copper produced (pounds)	Percent of copper	
Alaska				4,000
Arizona	1,087,707	97,775,170	4.49	[1] 716,606,000
California	9,097	826,500	4.54	25,442,000
Colorado	7,880	431,814	2.74	2,096,000
Idaho	2,732	218,200	3.99	3,376,000
Michigan				84,842,000
Missouri				6,604,000
Montana	68,503	4,885,713	3.57	[1] 236,380,000
Nevada	126,316	9,638,700	3.87	[1] 122,464,000
New Mexico	87,131	2,229,191	1.28	[1] 139,460,000
Oregon				6,000
South Dakota				2,000
Texas	3,799	224,335	2.95	230,000
Utah	2,667	367,434	6.89	[1] 565,150,000
Washington	36	13,800	19.17	[2] 12,338,000
Eastern States	143,568	1,470,600	.51	30,098,000
	1,539,436	118,081,457	3.84	1,945,098,000

[1] Considerable copper was recovered from precipitates.
[2] Most of the copper was from zinc-copper ores.

Copper ores produced in the United States, 1940–44, and average yield in copper, gold, and silver

Year	Smelting ores [1]		Concentrating ores [1]		Total				
	Short tons	Yield in copper (percent)	Short tons	Yield in copper (percent)	Short tons[1]	Yield in copper (percent)	Yield per ton in gold (ounce)	Yield per ton in silver (ounce)	Value per ton in gold and silver
1940	2,179,060	4.33	63,900,512	1.10	69,278,476	1.20	0.0078	0.300	$0.48
1941	2,135,138	4.29	72,531,712	1.06	78,452,504	1.15	0071	.239	.42
1942	2,221,191	4.00	85,865,167	1.02	92,285,626	1.09	.0063	.162	.34
1943	2,151,187	3.64	92,246,622	.97	98,119,735	1.04	.0055	.142	.29
1944	1,539,436	3.84	86,392,852	.94	91,063,648	.99	.0050	.130	.27

[1] Includes old tailings, etc.

Refinery production.—The refinery output of copper in the United States in 1945 was made by 11 plants; 7 of these employed the electrolytic method only, 2 the furnace process on Lake Superior copper, 1 the furnace process on western ores, and 1 both the electrolytic and the furnace methods. The Lake smelter of the Copper Range Co. was idle at the end of 1945.

Five large electrolytic refineries are on the Atlantic seaboard, three Lake refineries on the Great Lakes, and three electrolytic refineries west of the Great Lakes—one at Great Falls, Mont.; one at Tacoma, Wash.; and one at El Paso, Tex. In 1942 fire-refined copper was produced for the first time at the Hurley, N. Mex., plant of the Kennecott Copper Corp., and all of the plant output was treated by this method in 1945. The El Paso plant of the Phelps Dodge Refining Corp. produced furnace refined copper in addition to the usual electrolytic grade. Of the plants specified above, the Lake refinery of the Quincy Mining Co. has been idle since 1933.

In addition to the foregoing plants, that at Inspiration, Ariz., is equipped to make electrolytically refined copper direct from the liquors obtained from leaching; this copper is shipped as cathodes to other refineries, where it is melted and cast into merchant shapes.

The 13 plants indicated constitute what commonly are termed "regular refineries." Of these plants, 8 employ the electrolytic process, 4 the furnace process, and 1 both methods. The electrolytic plants, exclusive of the one at Inspiration, have a rated capacity of 1,556,000 tons of refined copper a year. As they produced 1,052,000 tons in 1945, this part of the industry was operated at 68 percent of capacity.

The following tables show the production of refined copper at regular refining plants, classified according to source, grade, and form in which cast.

Primary and secondary copper produced by regular refining plants in the United States and imported, 1941–45, in short tons

	1941	1942	1943	1944	1945
Primary:					
Domestic: [1]					
Electrolytic [2]	929,711	963,177	938,727	837,089	669,705
Lake [2]	45,697	46,523	44,867	41,597	29,995
Casting		55,092	98,485	95,166	76,038
	975,408	1,064,792	1,082,079	973,852	775,738
Foreign: [1]					
Electrolytic	419,901	343,834	297,184	247,335	298,128
Casting and best select		5,935			34,733
Refinery production, new copper	1,395,309	1,414,561	1,379,263	1,221,187	1,108,599
Imports, refined copper [3]	346,994	401,436	402,762	492,395	531,367
Total new refined copper made available	1,742,303	1,815,997	1,782,025	1,713,582	1,639,966
Secondary:					
Electrolytic [4]	95,437	83,079	114,259	78,402	[5] 84,044
Casting	4,238	2,064	8,205	7,996	12,618
	99,675	85,143	122,464	86,398	96,662
Grand total	1,841,978	1,901,140	1,904,489	1,799,980	1,736,628

[1] The separation of refined copper into metal of domestic and foreign origin is only approximate, as accurate separation at this stage of manufacture is not possible.
[2] Some copper from Michigan is electrolytically refined at eastern refineries and is included as electrolytic copper.
[3] Data include copper imported for immediate consumption plus material entering country under bond.
[4] Includes some secondary Lake copper.
[5] Copper from scrap at Lake refineries included under "casting" copper in 1945.

Copper cast in forms in the United States, 1944–45

Form	1944		1945	
	Short tons	Percent	Short tons	Percent
Wire bars	493,000	37.69	467,000	38.75
Cathodes	358,000	27.37	231,000	19.17
Ingots	229,000	17.51	213,000	17.68
Cakes	104,000	7.95	153,000	12.70
Other forms	124,000	9.48	141,000	11.70
	1,308,000	100.00	1,205,000	100.00

In addition to the regular refineries, many plants throughout the country operate on scrap exclusively, producing metallic copper and a variety of alloys. The output of these plants is not included in the statements of refined-copper production in the preceding tables but is included in the following statement on secondary-copper production.

Copper sulfate.—The production of hydrous copper sulfate or bluestone by copper refineries in the United States was 32,900 short tons having a copper content of 8,237 tons in 1945 compared with 33,100 tons containing 8,269 tons in 1944. The output of copper sulfate by plants other than the regular primary refineries totaled 92,600 tons with a reported content of 23,154 tons in 1945 compared with 69,500 tons containing 17,377 tons of copper in 1944. Producers held 10,300 tons of copper sulfate at the beginning of 1945, total production was 125,500 tons, and shipments amounted to 114,800 tons. Some small purchases were made by producers during the year, and producers used a quantity equivalent to 11 percent of shipments. Inventories at the year end were 9,400 tons.

SECONDARY COPPER

Secondary copper includes material recovered from remelting old copper and copper scrap and from the treatment of copper alloys or alloys treated without separation of the copper. The following table summarizes the production of secondary copper during 1941–45. Further details appear in the chapter on Secondary Metals—Nonferrous.

Secondary copper produced in the United States, 1941–45, in short tons

	1941	1942	1943	1944	1945
Copper recovered as unalloyed copper	135,869	114,647	137,883	102,135	112,856
Copper recovered in alloys	[1] 590,527	[1] 813,108	[1] 948,164	[1] 848,807	[1] 893,660
Total secondary copper	726,396	927,755	1,086,047	950,942	1,006,516
From new scrap	313,697	500,633	658,526	494,232	446,701
From old scrap	412,699	427,122	427,521	456,710	559,815
Percentage of domestic mine output	76	86	100	98	130

[1] Includes copper in chemicals, as follows: 1941, 9,804; 1942, 17,455; 1943, 13,019; 1944, 13,357; 1945, 18,666 tons.

CONSUMPTION

The following table gives figures on apparent consumption of copper in the United States, and data for a long period are available on this basis. In estimating apparent consumption it has been assumed that copper used in the manufacture of primary fabrications of copper is consumed. Statistics compiled upon a different basis (for example, by taking consumption as including only copper made into automobiles, electrical equipment, ships, and other items) would show very different results. Much copper leaves the country as primary fabrications and considerably more in manufactured products containing copper. During the war large quantities of copper exported for military use were not accounted for in the foreign trade statistics. Likewise, scrap or other materials imported in returning transport vessels were not listed in import figures. The method of calculating the quantity of copper available for consumption is shown in the following table. It should be noted that exports and stocks include some refined secondary copper that cannot be determined separately and also that actual consumption of new copper would differ from the figures shown in the table by the changes in the consumers' stocks.

New refined copper withdrawn from total year's supply on domestic account, 1941–45, in short tons

	1941	1942	1943	1944	1945
Total supply of new copper	1,742,303	1,815,997	1,782,025	1,713,582	1,639,966
Stock at beginning of year	91,500	77,500	84,000	68,500	81,000
Total available supply	1,833,803	1,893,497	1,866,025	1,782,082	1,720,966
Copper exported [1]	114,753	[2] 131,406	[2] 175,859	[2] 68,373	[2] 48,563
Stock at end of year	77,500	84,000	68,500	81,000	130,000
	192,253	215,406	244,359	149,373	178,563
Withdrawn on domestic account	1,641,550	1,678,091	1,621,666	1,632,709	1,542,403

[1] Includes refined copper in ingots, bars, rods, or other forms.
[2] Excludes refined copper in rods.

The Bureau of Mines began to compile figures on actual consumption of copper in 1945. The results of the first year's canvass are given in the following table. Unlike the foregoing table, which attempts to measure new copper only, the following one does not distinguish between new and old copper. It covers copper consumed in refined form. Actual consumption of new and old copper in 1945 was less than apparent consumption of new metal largely because the apparent figures do not take into account changes in industry and Office of Metals Reserve inventories (see section on Stocks) both of which rose in 1945.

Refined copper consumed [1] in 1945, by classes of consumers, in short tons

Form	Wire mills	Brass mills	Chemical plants	Secondary smelters	Foundries and miscellaneous	Total
Cathodes	14	239,072	105	7,943	11,585	258,719
Wire bars	504,129	57,949			326	562,404
Ingots and ingot bars	15,438	219,343	215	10,543	30,405	275,944
Cakes and slabs		158,061	4,800	101	61	163,023
Billets	1	108,364	67	120	433	108,985
Other		1,880	5,111	9	3,197	10,197
Total	519,582	784,669	10,298	18,716	46,007	1,379,272

[1] Reported consumption.

STOCKS

The following table gives domestic stocks of copper as reported by primary smelting and refining plants. Stocks of blister and anode copper in transit from smelters to refineries are included under blister copper.

Stocks of copper at primary smelting and refining plants in the United States at end of year, 1941–45, in short tons

Year	Refined copper	Blister and materials in process of refining [1]	Year	Refined copper	Blister and materials in process of refining [1]
1941	77,500	240,000	1944	81,000	311,000
1942	84,000	235,500	1945	130,000	331,000
1943	68,500	241,000			

[1] Includes copper in transit from smelters in the United States to refineries therein.

Inventories of copper in virtually all hands gained in 1945; but fabricators indicated that the excess of booked orders over stocks, which had been declining since 1942, rose again in 1945.

Producers' stocks of refined copper were 60 percent larger at the end than at the beginning of 1945 and of blister and materials in process of refining were 6 percent more.

At the end of 1945 the Office of Metals Reserve held 565,710 tons of electrolytic and fire-refined copper in cathodes, shapes, and "in process" copper, all but a small part of which was in the United States; the remainder was in Canada. The foregoing total represents an increase of 37 percent over the 412,635 tons of refined copper held at the end of 1944. A substantial part of the metal on hand at the end of 1945 was blister copper and fire-refined copper that would not meet all specifications for refined metal, and only a relatively small part was in the form of wire bars. The large size of the stock pile thus did not indicate that industry could operate without new production for virtually 6 months at the 1940 rate of consumption of new copper. The anticipated large demand for wire bars in 1946 tended to accentuate the disproportionate nature of the items in the stock pile from the point of view of immediate consumption. The foregoing stocks are upon an ownership basis and therefore duplicate, in part, stocks of refined and "in process" copper reported by the refineries, which are on a physical plant basis. Of the Office of Metals Reserve inventories at the end of 1944, 11 percent was in the form of cathodes and shapes at refineries.

Stocks of copper in fabricators' hands at end of year, 1941–45, in short tons

	Stocks of refined copper [1]	Unfilled purchases of refined copper from producers	Working stocks	Unfilled sales to customers	Excess stocks over orders booked
1941	295,813	241,335	291,515	547,468	−304,675
1942	414,668	135,481	340,547	613,005	−403,403
1943	353,948	90,807	299,796	465,258	−320,299
1944	334,017	53,538	289,160	285,654	−187,259
1945	375,618	44,100	268,490	362,436	−211,208

[1] Includes in process metal and primary fabricated shapes. Also includes small quantities of refined copper held at refineries for fabricators' account.

Metal held by fabricators gained from 334,017 tons at the end of 1944 to 375,618 at the end of 1945. Unfilled sales, however, which had been pared from 613,005 tons at the end of 1942 to 285,654 at the end of 1944, rose to 362,436 tons in 1945. The excess of booked orders over stocks therefore rose in 1945 from 187,259 tons to 211,208. The oversold condition at the end of 1945, nonetheless, was vastly reduced from that which existed when unfilled sales were at their peak of 689,177 tons on June 30, 1942.

Figures compiled by the Copper Institute show that domestic stocks of refined, duty-free copper increased from 66,780 tons at the end of 1944 to 76,512 tons at the end of 1945. Inventory data of the Copper Institute and the Bureau of Mines are on different bases and, as a result, never agree. Under usual conditions the differences are due, in part, to the somewhat different coverage and in part to an arbitrary but permissible method used by the Copper Institute in designating the copper as domestic or foreign metal. Copper produced from foreign crude materials and held at refineries at the end of the year is included in Bureau of Mines inventory figures.

PRICES

Reports to the Bureau of Mines from copper-selling agencies indicate that 860,000 short tons of copper were delivered to domestic and foreign purchasers (excluding deliveries of foreign copper to the Metals Reserve Company) in 1945 at an average price (f. o. b.

Salient statistics covering bonus payments[1] of the Government from the inception of such payments (February 1, 1942) through 1945

	1942 (February-December)		1943		1944		1945[2]	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Production:								
At ceiling price	881,711	89.23	841,286	77.12	722,791	74.53	561,851	72.57
At overceiling prices:								
Under Premium Price Plan—								
A quota only (17 cents a pound)	102,352	10.36	217,382	19.93	194,483	20.06	179,389	23.17
Special (17.01–27 cents a pound)	716	.07	14,003	1.28	26,168	2.70	22,917	2.96
	103,068	10.43	231,385	21.21	220,651	22.76	202,306	26.13
Metals Reserve mine contracts	[3] 3,315	.34	18,147	1.67	26,347	2.71	10,075	1.30
Total overceiling production	106,383	10.77	249,532	22.88	246,998	25.47	212,381	27.43
Total production	988,094	100.00	1,090,818	100.00	969,789	100.00	774,232	100.00
	Total	Price per pound (cents)	Total	Price per pound (cents)	Total	Price per pound (cents)	Total	Price per pound (cents)
Payments:								
Under Premium Price Plan—								
A quota only	$10,306,829	17.00	$23,138,490	17.00	$22,065,137	17.00	$20,230,618	17.00
Special	20,623	18.44	1,735,266	23.20	3,450,898	23.59	3,198,357	23.98
	10,327,452	17.01	24,873,756	17.38	25,516,035	17.78	23,428,975	17.79
Metals Reserve mine contracts	[3] 188,117	14.84	3,488,489	21.61	4,258,562	20.08	2,115,933	22.50
Total overceiling payments	10,515,569	16.94	28,362,245	17.68	29,774,597	18.03	25,544,908	18.01
Total United States production	----------	12.25	----------	13.30	----------	13.54	----------	13.65

[1] Compiled from a report of the Office of Price Administration. Data subject to revision.
[2] Preliminary figures obtained from the Office of Price Administration. Data subject to revision.
[3] Treasury (Procurement) contracts in 1942.

refinery) of 11.8 cents a pound, unchanged from 1944, 1943, 1942, and 1941. The averages for 1942–45 exclude bonuses paid for over-quota outputs of individual mines, which were first applicable to February 1942 tonnages. The following table gives details covering bonus payments since they began.

Average monthly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States, 1944–45, in cents per pound

Month	1944			1945		
	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]	Domestic f. o. b. refinery [1]	Domestic f. o. b. refinery [2]	Export f. o. b. refinery [2]
January	11.87	11.775	11.700	11.87	11.775	11.700
February	11.87	11.775	11.700	11.87	11.775	11.700
March	11.87	11.775	11.700	11.87	11.775	11.700
April	11.87	11.775	11.700	11.87	11.775	11.700
May	11.87	11.775	11.700	11.87	11.775	11.700
June	11.87	11.775	11.700	11.87	11.775	11.700
July	11.87	11.775	11.700	11.87	11.775	11.700
August	11.87	11.775	11.700	11.87	11.775	11.700
September	11.87	11.775	11.700	11.87	11.775	11.700
October	11.87	11.775	11.700	11.87	11.775	11.700
November	11.87	11.775	11.700	11.87	11.775	11.700
December	11.87	11.775	11.700	11.87	11.775	11.700
Average for year	11.87	11.775	11.700	11.87	11.775	11.700

[1] As reported by The American Metal Market Co.
[2] As reported by Engineering and Mining Journal.

Average yearly quoted prices of electrolytic copper for domestic and export shipments, f. o. b. refineries, in the United States and for spot copper at London, 1936–45, in cents per pound

	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
Domestic f. o. b. refinery [1]	9.58	13.27	10.10	11.07	11.40	11.87	11.87	11.87	11.87	11.87
Domestic f. o. b. refinery [2]	9.474	13.167	10.000	10.965	11.296	11.797	11.775	11.775	11.775	11.775
Export f. o. b. refinery [2]	9.230	13.018	9.695	10.727	10.770	10.901	11.684	11.770	11.770	11.770
London spot [2] [3]	9.465	13.097	9.912	[4] 10.066	([5])	([5])	([5])	([5])	([5])	([5])

[1] As reported by The American Market Co.
[2] As reported by Engineering and Mining Journal.
[3] Conversion of English quotations into American money based on average rates of exchange recorded by Federal Reserve Board of Treasury.
[4] Average for 8 months; thereafter, London Metal Exchange dealings suspended for duration of war.
[5] No quotations.

Ceiling price limitations, placed by the Office of Price Administration on electrolytic and casting copper, were described in earlier reports of this series. There were no changes in the ceilings in 1945. The Premium Price Plan also described in earlier reports, permitted Government payment of 5 cents a pound above the ceiling price to high-cost producers and to other producers for production from high-cost sections of mines. Special bonuses were permitted where the ceiling price plus the 5-cent bonus failed to cover mine costs; and, as is shown by the foregoing table, such payments in some instances aggregated as much as 27 cents, including the ceiling price. Bonuses have been paid on a higher percentage of output in each year—that is, on 11 percent in 1942 (February-December), 23 percent in 1943, 25 percent in 1944, and 27 percent in 1945. Total bonus payments declined 14 percent in 1945, so that the gain in percentage noted for

717372—47——10

that year was due to a fall of 22 percent in the nonpremium output. The gain in percentage of premium production was in the "A" class, as special bonuses were little changed percentagewise and Office of Metals Reserve contract payments fell from 2.7 to 1.3 percent largely because of the lapse in contracts with the Copper Range Co., the Quincy Mining Co., and the Isle Royale Copper Co. at the end of August. Mines of the first two companies closed, but Isle Royale operated under an "A" quota beyond the end of the year. The net result of the bonus plan was a rising average price: 12.25 cents in 1942, 13.30 in 1943, 13.54 in 1944, and 13.65 in 1945.

The official maximum prices, delivered to consumers' plants, have prevailed in the London market since December 18, 1939:

	Per long ton £	s.	d.
Electrolytic high conductivity	62	--	--
Fire refined:			
High conductivity	62	--	--
High grade	61	10	--
Minimum, 99.7 percent	61	--	--
Minimum, 99.2 percent	60	10	--
Hot-rolled black wire rods	65	10	--

FOREIGN TRADE[11]

The prewar movement of copper from producing to consuming centers was widely disrupted by the war. Before the war the United States, through its smelting, refining, and fabricating facilities, handled large quantities of foreign crude materials which were subsequently exported in finished form for consumption abroad. Such copper was not subject to the United States import tax because the copper was not for ultimate consumption here. After the outset of World War II the United States needed all the copper that entered the country in order to fill its huge armament requirements. Moreover, most of the chief prewar markets were no longer available to exports from the United States. In 1945 the United States continued to require large quantities of copper in its highest form of purity—refined—to supply new peak consumption needs in the first part of the year, and this class of imports again established a new annual record. The refined class represented 62 percent of the total unmanufactured copper entered in 1945, and blister, the next grade, 28 percent. In 1939 the respective percentages were 5 and 73. Chile for years has been the chief supplier of refined-copper imports, but its preeminent position declined somewhat, with a drop in tonnage in 1945. War needs of the British Empire subsided before those of the United States did, and late in 1944 imports of refined copper from Canada into the United States gained notably. In 1945, with British Empire contracts for Canadian and Rhodesian copper terminated and with Belgian Congo copper also diverted, the United States received 76,392 tons of refined copper from Canada, 41,782 tons from Belgian Congo, and 25,166 tons from Northern Rhodesia. The change in the British Empire supply position also released 64,374 tons of Rhodesian blister to the United States in 1945 compared with none in earlier war years. Other import

[11] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

features were outstanding gains in receipts of unrefined black blisert from Mexico and Belgian Congo and sharp drops in this grade from Chile and in regulus from Belgian Congo. The movements in lower grades were diverse with respect to countries, but imports of concentrates declined in continuation of the down trend in receipts of this low-grade material, with a contrasting slight upswing in receipts of ore.

Previous reports of this series have described the swing away from domestic participation in prewar export markets. Japan and Europe were formerly the chief destinations of United States exports of refined copper, for many years the largest export class. Of the most important export destinations in prewar years only the United Kingdom continued to receive large quantities of copper during the war. The U. S. S. R. joined the United Kingdom as a chief recipient of refined copper in 1942, having taken the lead in that year as a destination of wire. The U. S. S. R. received little refined metal in 1945 but continued to be the principal destination of exports of wire. One of the features of the war, as far as copper was concerned, was the sharp rise in exports of wire to the outstanding position in 1944 among the export classes, a position long held by the refined class. Exports of wire dropped sharply in 1945 but continued to lead all other groups.

IMPORTS

The tendency to stress imports of the higher grades of copper as the war progressed continued in 1945, and receipts of the refined class were higher than ever before. A noteworthy rise in entries of unrefined black blister and converter copper, the next lower grade, however, caused the relation of refined to total unmanufactured copper to drop from 63 to 62 percent, the first decline since 1938. Shipping space was utilized to best advantage, and time was saved in prosecution of the war by importation of the higher grades. Chile had supplied almost all of the refined copper that entered the United States from the time the excise tax was imposed in 1932 until midyear 1944. Thereafter, with the United Kingdom in a more abundant supply position, increased quantities of refined metal began to arrive from Canada, and in 1945 important quantities were received also from Belgian Congo and Northern Rhodesia. Total imports of refined copper rose 8 percent in 1945, and those of unrefined copper gained 39 percent. The increase in receipts of unrefined copper was also influenced by the lessened interest of the United Kingdom in copper supplies; receipts from Northern Rhodesia totaled 64,374 tons in 1945 compared with none in 1944, and those from Belgian Congo were 29,758 compared with 13,247. These gains and a large rise in receipts from Mexico much more than counteracted the sharp cut from Chile. Declines were noted in entries of regulus and concentrates of 61 and 18 percent, respectively. The former drop was because Belgian Congo shipped less of this grade, and the latter was due to reduced quantities for most countries except Bolivia, Chile, and Cuba. Larger imports of ore from Chile were the chief cause of the rise in this class of imports in 1945.

Copper (unmanufactured) imported into the United States, 1944–45, by countries, in short tons [1]

Country	Ore (copper content)	Concentrates (copper content)	Regulus, black or coarse copper and cement (copper content)	Unrefined black blister and converter copper in pigs or converter bars	Refined in ingots, plates, or bars	Old and scrap copper, fit only for remanufacture, and scale and clippings
1944						
Africa, British:						
Northern Rhodesia [2]		156	1			
Union of South Africa		1,030	13			
Argentina			112			
Australia	343	76				479
Belgian Congo			50,311	13,247		
Bolivia	974	2,810	14			
Canada	11	20,015	303	40	41,323	502
Chile	4,415	4,180	39	89,758	450,610	
Cuba		7,123				
Cyprus		3,925				
Ecuador	8	5		4,088		
Mexico	177	8,518	30	37,473		
Newfoundland and Labrador		5,886				
Panama: Canal Zone						17
Peru	485	5,319	189	28,062	462	
Turkey				2,756		
Other countries	2	11				68
	6,415	59,054	51,012	175,424	492,395	1,066
1945						
Africa, British:						
Northern Rhodesia [2]		414	8	64,374	25,166	
Union of South Africa		150	19	6,114	783	
Australia	(3)	102	909			137
Belgian Congo			18,084	29,758	[4] 41,782	
Bolivia	350	4,579	10			
Canada		13,117	456		76,392	1,186
Chile	7,185	5,190		54,855	384,843	
Cuba	216	9,206				
Ecuador		4		3,622		
Mexico	121	7,599	8	58,841	44	
Mozambique					1,665	
Newfoundland and Labrador		4,463				
Peru	983	3,795	368	25,537	692	
Other countries	3	13				53
	8,858	48,632	19,862	243,101	531,367	1,376

[1] Data include copper imported for immediate consumption plus material entering the country under bond.
[2] Tonnages credited to Southern Rhodesia by the U. S. Department of Commerce have been added to Northern Rhodesia.
[3] Less than 1 ton.
[4] Refined copper credited to Portuguese Guinea and Angola by the U. S. Department of Commerce has been added to Belgian Congo.

Copper (unmanufactured) imported [1] *into the United States, 1941–45*

Year	Short tons	Year	Short tons
1941	735,545	1944	785,366
1942	764,393	1945	853,196
1943	716,654		

[1] Data include copper imported for immediate consumption plus material entering country under Bond.

EXPORTS

It was almost possible to trace the battle areas of the world from a study of United States exports of insulated copper wire and cable. Although refined copper had dominated the export group, usually by a very substantial margin, from before 1900, the wire classification rose sharply during the war and stood first in 1944 and again in 1945. U. S. S. R. and Egypt took the largest quantities in 1942, U. S. S. R., United Kingdom, India, Egypt, New Zealand, Australia, and Algeria in 1943, and U. S. S. R., United Kingdom, India, and New Zealand in 1944. U. S. S. R. continued ahead of all others in 1945, and no other single country received one-tenth as much. Refined copper ranked second in 1945, and exports of this class declined 29 percent. The United Kingdom was the chief recipient of shipments of refined copper from the United States from 1941 through 1945, inclusive, but the 1945 quantity was only 46 percent of that for 1944. Mexico and Brazil stood second and third in 1945, with almost identical quantities, and the European Continent reentered the United States market for refined copper in 1944 and was credited with the receipt of its first tonnages in 1945, Switzerland, France, Belgium, and Sweden having received quantities ranging from 1,400 to 4,100 tons.

Exports of rods rose sharply in 1945, chiefly because of large shipments to Sweden. All other grades of primary fabrications were shipped in smaller quantities in 1945 than in 1944.

The drastic changes in destinations of United States exports of copper from prewar to war years were noted in previous reports of this series.

Copper [1] exported from the United States, 1941–45

Year	Short tons		Value	Year	Short tons		Value
	Metallic [2]	Total			Metallic [2]	Total	
1941	158,893	158,905	$46,196,275	1944	237,515	237,515	$101,837,979
1942	210,518	213,942	78,563,236	1945	132,545	132,579	54,105,793
1943	294,459	295,699	107,598,224				

[1] Exclusive of "Other copper manufactures" valued at $1,493,265 in 1941; $3,759,403 in 1942; $1,121,230 in 1943; $859,421 in 1944; and $1,000,008 in 1945.
[2] Exclusive of ore, concentrates, and composition metal; exclusive also of unrefined copper, figures for which are not separable from those for ore and concentrates.

Copper exported from the United States, 1945,[1] by countries, in short tons

	Ore, concentrates, composition metal, and unrefined copper (copper content)	Refined		Old and scrap	Pipes and tubes	Plates and sheets	Wire (except insulated)	Insulated wire and cable	Other copper manufactures
		Bars, ingots, or other forms	Rods						
Algeria		595	31		97	30	79	330	
Argentina		(2)			18	2	87	169	
Australia	(2)	169	(2)		1	(2)	10	156	
Belgian Congo		6	(2)		4	3	23	108	
Belgium and Luxembourg		1,680							
Brazil		5,674	347		726	878	31	174	
Canada	1	55	120	19	315	82	153	1,025	
Chile		4	5		46	7	130	743	
China		542	3		51	241	455	240	
Colombia		183	1		71	573	589	1,587	
Cuba	2	8	9		768	103	495	1,710	
Egypt		6			2	2	11	91	
France		3,646	(2)		(2)		6	823	
Iceland					18	3	65	748	(3)
India and dependencies		1			12	8	51	2,745	
Mexico	1	5,690	35	1	342	249		1,400	
Morocco, French		1	2		47	31	64	68	
New Zealand					(2)	9	616	189	
Norway			1,548				11	58	
Panama, Republic of		1			34	27	9	224	
Peru		2	2		31	34	145	680	
Sweden		1,432	2,240		2		5	29	
Switzerland		4,088		113			503		
U. S. S. R.		220	1		1,060	529	5,592	36,707	
United Kingdom	30	19,281	(2)		(2)	21	(2)	2,702	
Uruguay		176	1		74	62	168	1,073	
Venezuela		56	3	(2)	110	247	308	1,408	
Other countries		5,047	661		358	656	1,858	4,205	
	34	48,563	5,009	133	4,187	3,797	11,464	59,392	(3)
Total value	$7,720	$10,437,329	$1,443,816	$26,572	$4,168,857	$1,841,173	$4,161,472	$32,018,854	$1,000,008

[1] Changes for table in Minerals Yearbook, 1944, p. 145, are as follows: Wire (except insulated) exported to Cuba should read 157 tons, New Zealand, 702 tons, U. S. S. R., 5,779 tons, other countries, 1,259 tons, total, 9,905 tons.

[2] Less than 1 ton.

[3] Figures for quantity not recorded.

Brass and bronze exported from the United States, 1944–45, by classes

Class	1944		1945	
	Short tons	Value	Short tons	Value
Ingots	329	$110,483	5,935	$1,517,195
Scrap and old	38	5,690	421	82,946
Bars and rods	23,014	7,779,442	8,662	3,248,471
Plates and sheets	110,045	40,442,974	25,181	9,287,821
Pipes and tubes	5,791	3,543,839	1,759	1,083,399
Pipe fittings	166	298,398	285	469,933
Pipe valves	841	1,565,770	(1)	(1)
Plumbers' brass goods	103	207,963	372	558,702
Wire of brass or bronze	3,882	2,107,421	1,548	1,080,242
Brass wood screws	(2)	54,071	(2)	117,394
Hinges and butts of brass or bronze	(2)	37,773	(2)	45,605
Other hardware of brass or bronze	(2)	159,158	(2)	285,923
Other brass or bronze manufactures	(2)	5,383,809	(2)	3,271,884
		61,696,791		21,049,515

[1] Beginning Jan. 1, 1945, classified under "Industrial machinery."
[2] Weight not recorded.

Unmanufactured brass exported from the United States, 1941–45

[Ingots, bars and rods, and plates and sheets]

Year	Short tons	Value	Year	Short tons	Value
1941	39,497	$14,558,425	1944	133,388	$48,332,899
1942	74,129	27,860,957	1945	39,778	14,053,487
1943	94,617	36,347,655			

Copper sulfate (blue vitriol) exported from the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	34,511	$2,950,714	1944	28,922	$2,843,941
1942	35,082	3,443,922	1945	34,967	3,419,332
1943	30,367	3,074,668			

WORLD PRODUCTION

World output of copper is believed to have approximated 3,000,000 short tons annually in 1941–43, inclusive. Incomplete data indicate that output in 1945 was roughly 20 percent less than in 1943. Previous reports of this series have stressed the fact that the Axis Powers were sharply deficient in regard to supplies of copper, a lack that helped speed their defeat.

World mine and smelter production of copper, 1939–45, in metric tons

[Compiled by B. B. Waldbauer]

Country	Mine							Smelter						
	1939	1940	1941	1942	1943	1944	1945	1939	1940	1941	1942	1943	1944	1945
North America:														
Canada	276,157	297,371	291,802	273,819	260,900	248,145	216,038	[1] 229,367	[1] 256,294	[1] 254,489	[1] 244,040	[1] 232,740	[1] 224,437	[1] 198,604
Cuba	9,964	10,500	9,838	[2] 8,916	6,405	6,584	9,067							
Mexico	44,390	37,602	48,716	51,379	49,774	41,302	61,680	39,045	31,252	40,914	44,729	43,013	32,974	53,287
Newfoundland	10,341	9,426	6,651	5,666	5,669	5,021	4,693							
United States	660,717	796,582	869,214	979,811	989,568	882,277	701,154	[3] 698,323	[3] 922,364	[3] 1,015,346	[3] 1,111,458	[3] 1,103,918	[3] 1,022,382	[3] 784,173
	1,001,569	1,151,481	1,226,221	1,319,591	1,312,316	1,183,329	992,632	966,735	1,209,910	1,310,749	1,400,227	1,379,671	1,279,793	1,036,064
South America:														
Bolivia [2]	4,056	6,660	7,274	6,376	6,011	6,170	6,097							
Chile	339,173	352,010	465,467	489,158	509,378	[4] 498,319	470,195	324,591	336,861	453,594	477,733	489,320	500,573	462,588
Ecuador	2	[5] 1,462	[5] 3,209	[5] 1,587	4,418	3,009	3,649					4,030	3,708	3,649
Peru	35,616	43,965	36,822	35,332	33,407	32,396	28,833	34,115	33,678	28,289	29,473	28,215	26,888	25,512
	378,847	404,097	512,772	532,453	553,214	539,894	508,774	358,706	370,539	481,883	507,206	521,565	531,169	491,749
Europe:														
Belgium [6]								65,850	28,660	15,820	16,950	18,320	4,310	(7)
Bulgaria	320	560	(7)	(7)	(7)	(7)	(7)							
Finland	11,797	[4] 15,246	[4] 16,522	[4] 15,623	[4] 15,488	[4] 15,841	[8] 15,000	13,246	10,862	8,783	13,263	15,535	[4] 7,726	[4] 11,811
France	(7)	99	101	65	25	(7)	(7)	[9] 1,701	[9] 932	[9] 659	[9] 407	[9] 118	[9] 122	(7)
Germany [8], Austria [8]	30,000	30,000	24,000	24,000	23,000	25,000	(7)	[9] 67,000	[9] 51,200	[9] 46,900	[9] 41,100	[9] 37,000	[9] 30,000	(7)
Hungary	(7)	(7)	(7)	(7)	(7)	(7)	(7)							
Italy	846	1,372	1,268	(7)	(7)	(7)	(7)	2,577	2,439	2,917	898	[10] 1,432	(7)	(7)
Norway	20,358	15,529	17,988	15,471	16,248	14,462	(7)	10,458	6,730	5,017	4,597	2,014	937	(7)
Portugal	(7)	(7)	(7)	(7)	(7)	(7)	(7)							
Rumania	(7)	(7)	(7)	(7)	(7)	(7)	(7)	729	25	124	46	70	(7)	(7)
Spain	(7)	(7)	(7)	(7)	(7)	(7)	(7)	10,445	9,422	8,900	11,590	10,952	10,891	5,042
Sweden	9,610	(7)	(7)	(7)	(7)	(7)	(7)	11,458	12,815	13,468	16,537	16,638	16,205	(7)
U. S. S. R. [11]	[12] 130,548	[12] 157,000	(7)	[8,12] 160,000	(7)	(7)	(7)	130,548	157,000	(7)	[8] 160,000	(7)	(7)	(7)
United Kingdom	(7)	(7)	(7)	(7)	(7)	(7)	(7)	[8] 4,000	[8] 4,500	(7)	(7)	(7)	(7)	(7)
Yugoslavia	64,200	(7)	(7)	(7)	(7)	(7)	(7)	41,658	[4] 42,951	(7)	(7)	[8] 80,000	(7)	(7)
	(7)	(7)	(7)	(7)	(7)	(7)	(7)	359,670	327,536	(7)	(7)	(7)	(7)	(7)

Asia:														
China [13]	[12] 1,497	[12] 2,269	[12] 1,590	[12] 1,255	[12] 1,146	[10] [12] 659	(7)	1,497	2,269	1,590	1,255	1,146	[10] 659	(7)
Cyprus (exports)	21,070	6,040			6,090	1,400	(7)							
India (including Burma)	[8] 12,000	[8] 14,000	[8] 13,000	[8] 13,000	[8] 12,000	(7)	(7)	6,640	6,757	6,116	5,968	6,198	(7)	(7)
Japan:														
Japan proper	[4] [8] 91,000	[4] [8] 95,000	(7)	(7)	(7)	(7)	(7)	[4] [8] 104,000	[4] [8] 124,000	(7)	(7)	(7)	(7)	(7)
Formosa (Taiwan)	[8] 4,000	[8] 4,000	(7)	(7)	(7)	(7)	(7)							
Netherlands Indies	94	(7)	(7)	(7)	(7)	(7)	(7)							
Philippine Islands	7,496	9,259	[8] 9,900	(7)	(7)	(7)	(7)							
Turkey	[12] 6,736	8,754	10,507	8,257	10,000	[12] 11,404	[12] 9,800	6,736	8,754	10,427	8,242	9,715	11,404	9,800
U. S. S. R.	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
	[11] 143,893	(7)	(7)	(7)	(7)	(7)	(7)	[11] 118,873	[11] 141,780	(7)	(7)	(7)	(7)	(7)
Africa:														
Algeria	(7)	(7)	(7)	(7)	5	44	(7)							
Belgian Congo	[12] 122,649	[12] 148,829	[12] 162,167	[12] 165,938	[12] 156,850	[12] 165,484	[12] 160,200	122,649	148,829	162,167	165,938	156,850	165,484	160,200
French Morocco	38	22	113	267	218	549	(7)							
Rhodesia:														
Northern	[12] 215,065	[12] 266,605	[12] 231,917	[12] 250,564	[12] 255,027	[12] 224,397	[12] 195,600	215,065	266,605	231,917	250,564	255,027	224,397	195,600
Southern	(7)	(7)	(7)	(7)	(7)	(7)	(7)							
South-West Africa	3,530	1,485	(7)	1,600	(7)	(7)								
Union of South Africa	10,998	13,350	(7)	(7)	(7)	(7)	(7)	14,089	17,024	18,601	23,877	22,150	22,396	[14] 17,445
	(7)	(7)	(7)	(7)	(7)	(7)	(7)	351,803	432,458	412,685	440,379	434,027	412,277	373,245
Oceania: Australia	20,890	20,037	21,194	20,729	24,716	28,475	27,700	18,154	18,432	22,016	25,004	20,785	20,217	26,300
World total	2,192,200	[8] 2,400,000	[8] 2,600,000	[8] 2,700,000	[8] 2,800,000	[8] 2,600,000	[8] 2,200,000	2,174,000	2,500,700	[8] 2,700,000	[8] 2,800,000	[8] 2,800,000	[8] 2,600,000	[8] 2,200,000

[1] Copper content of blister produced.
[2] Copper content of exports.
[3] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1939, 646,524 tons; 1940, 824,703 tons; 1941, 876,401 tons; 1942, 987,004; 1943, 991,492; 1944, 910,245; 1945, 710,073.
[4] According to Yearbook of American Bureau of Metal Statistics.
[5] United States imports.
[6] Figures represent blister copper only. In addition to blister copper, Belgium reports a large output of refined copper which is not included above as it is believed produced principally from crude copper from Belgian Congo and would therefore duplicate output reported under the latter country.
[7] Data not available.
[8] Approximate production.
[9] Exclusive of material from scrap.
[10] January to June, inclusive.
[11] Output from U. S. S. R. in Asia included under U. S. S. R. in Europe.
[12] Smelter product.
[13] Unoccupied China.
[14] January to September, inclusive.

REVIEW BY COUNTRIES

Canada.—Production of copper dropped from 273,535 short tons in 1944 to 238,142 tons in 1945, or 13 percent, a continuation of the movement in progress since the peak of 327,797 tons was reached in 1940. Labor shortages had much to do with the general down trend, and the ending of hostilities sharpened the drop in 1945. Moreover, as has been pointed out in previous reports of this series, Canadian copper occurs for the most part in ores carrying high values in other metals, such as nickel, zinc, and gold. Half of the output in 1945, for example, came from the nickel-copper mines of the Sudbury district, Ontario. The demand for nickel has a strong influence on the rate of copper output from such ores. The International Nickel Co. of Canada, Ltd., largest copper producer in Canada, began to curtail operations in August and by the year end, according to the annual company report to stockholders, the production of nickel was down to about 50 percent of the expanded capacity. The majority of United States Government foreign purchase contracts were terminated as of October 31, 1945. Fears recurred in some quarters that Canadian surplus copper would be without an adequate outlet, but late in 1945 it was made known that, for the first 6 months, at least, of 1946, the United Kingdom would buy not only all available Rhodesian copper but that from Canada as well. The Canadian purchase price was said to be 13½ cents (Canadian funds) a pound c. i. f. United Kingdom ports. Canadian Government restrictions on the purchase of domestic copper were removed in August. Statistics prepared by the Northern Miner and published in the May 16, 1946, issue show that Canada produced 35 percent of its all-time output of copper in World War II. Although Canada began to produce copper in 1886 and output to the end of 1945 had reached 10,199,539,257 pounds, 3,501,116,946 pounds were produced in 1940–45, inclusive. Mine production, by Provinces, is shown in the accompanying table.

Copper produced (mine output) in Canada, 1941–45, by Provinces, in short tons

Province	1941	1942	1943	1944	1945 (preliminary)
British Columbia	33,164	25,008	21,111	18,153	12,899
Manitoba	33,509	23,798	19,008	21,940	20,050
Ontario	166,915	154,141	138,920	142,655	118,174
Quebec	71,892	70,456	65,582	54,029	53,819
Saskatchewan	16,162	28,391	42,974	36,758	33,200
	[1] 321,658	[1] 301,831	287,595	[1] 273,535	238,142

[1] Includes Northwest Territories.

As has already been mentioned, half of the output of copper in 1945 came from the nickel-copper mines of the Sudbury district, Ontario; usually the proportion from this Province is even higher. According to the annual report to stockholders of the International Nickel Co. of Canada, Ltd., the war years imposed an extraordinarily heavy drain on ore reserves. Totals of 12,105,545, 12,117,567, and 10,136,350 short tons of ore were mined in 1943, 1944, and 1945, respectively, compared with an annual average of 5,321,634 tons for the prewar period, 1936–38. However, through an extensive diamond-drilling and exploration program the development of new ore was such that at the end of 1945 proved ore reserves totaled 217,373,000 tons, containing 6,866,000 tons of nickel and copper, compared with 212,368,000 tons, containing 6,806,000 tons of nickel and copper, at the end of 1938. International's sales of copper in all forms totaled 107,862 tons in 1945 compared with 132,356 tons in 1944 and 126,989 in 1943. Copper sales for the 3-year period exceeded nickel sales slightly. The Falconbridge Nickel Mines, Ltd., the other important producer in Ontario, hoisted 715,896 tons of ore and recovered 1,209 tons from the surface dump. In all, 716,868 tons were treated and yielded 19,470 tons of matte that contained 10,349 tons of nickel and 5,271 tons of copper. At the end of 1945 ore reserves totaled 13,682,000 tons, containing an average of 1.72 percent nickel and 0.93 percent copper, of which 7,935,500 tons were in the Falconbridge mine.

Production from copper-gold, copper-zinc, and copper-pyrites ores in western Quebec caused that Province to rank second in Canada. In comparison with 1944, Quebec, with a production drop of less than one-half of 1 percent, compared with 13 percent for Canada as a whole, made a better showing than any other Province. Noranda Mines, Ltd., is the chief producer in Quebec. A total of 1,330,534 tons of ore was hoisted at the Horne mine in 1945; 858,523 tons were milled, and 626,571 tons of ore and concentrate were smelted. The smelter treated 296,520 tons of custom material in addition. Copper production for the Horne mine was 26,783 tons of a total smelter output of 51,162 tons. In addition to copper, the Horne mine produced 174,217 ounces of gold and 439,330 ounces of silver. Developed ore reserves above the 2,975-foot level at the end of 1945 were 5,127,000 tons of sulfide ore averaging 7.08 percent copper, 15,228,000 tons of sulfide ore averaging 0.68 percent, and some siliceous fluxing ore. Labor shortages caused Noranda to cut its ore-treatment schedule by one-third in midyear and forced underground development to a virtual standstill. At the Normetal Mining Corp., Ltd., property 204,067 tons of ore were concentrated in 1945 compared with 192,994 tons in 1944, and the concentrates produced contained 6,934 and 5,889 tons, respectively, of copper. Ore reserves at the end of 1945 totaled 1,399,000 tons containing 3.53 percent copper and 7.04 percent zinc. Waite Amulet Mines, Ltd., produced 17,992 tons of copper from 517,213 tons of ore milled, decreases from 20,504 and 608,574 tons, respectively, in 1944. Total ore reserves of all grades at the end of 1945 were 2,500,000 tons in the Waite Amulet and Amulet Dufault mines, of which 2,200,000 tons in the Amulet Dufault mine contained averages of 6.01 percent copper and 4.26 percent zinc. Canadian Copper Refiners, Ltd., in which Noranda Mines, Ltd., has an interest of more than 92 percent, produced 96,000 tons of refined copper in 1945. The new company copper sulfate plant began to produce in June. It was recently described.[12] According to the Preliminary Report on the Mineral Production of Canada in 1945:

> One of the most interesting developments during the year under review was an extensive exploration program conducted by Quemont Mining Corporation, Ltd., on an important copper-gold-silver deposit adjoining the property of Noranda Mines, Ltd., in the Rouyn area of Quebec.

[12] Canadian Chemistry and Processing Industries, Copper Sulfate: Vol. 30, No. 4, April 1946, pp. 26–29.

The Hudson Bay Mining & Smelting Co., Ltd. (Flin Flon mine), and Sherritt Gordon Mines, Ltd., regularly account for the copper production of Manitoba and Saskatchewan. At the Flin Flon mine, 1,822,628 tons of ore were mined and milled, from which were produced 40,098 tons of copper, 47,468 tons of zinc, 131,239 ounces of gold, and 1,694,184 ounces of silver. In contrast with most other Canadian producers, Sherritt Gordon Mines, Ltd., produced more copper in 1945 than in 1944. A total of 646,092 tons of ore was mined and milled in 1945, a drop from 731,783 tons in 1944; a higher recovery of copper per ton of ore, however, resulted in the production of 13,117 tons in 1945—an increase over the 12,271 tons in 1944. In addition to the copper produced in 1945, 7,154 ounces of gold, 229,703 ounces of silver, and 18,773 tons of zinc concentrates (50 percent zinc) were recovered. Total copper-ore reserves at the end of 1945 were calculated to be 2,026,000 tons, containing 2.65 percent copper and 2.25 percent zinc.

Operations at properties of the Granby Consolidated Mining, Smelting & Power Co., Ltd., and Britannia Mining & Smelting Co., Ltd., chief copper producers in British Columbia, were hampered by labor deficiencies throughout most of the war period, but the situation was reported to have improved at the end of 1945.

The chief items in Canada's import classification were copper sulfate and copper in bars or rods for the manufacture of various electric wires and cables. Of the former class, 3,259 tons were entered in 1945, compared with 4,130 tons in 1944, and of the latter 1,263 and 289 tons, respectively. Exports for 1945 (comparison with 1944 in parentheses) were as follows: Copper in ingots, bars, cakes, slabs, and billets, 129,349 (135,233) tons; copper contained in ores, matte, and regulus, 19,295 (27,989) tons; copper in rods, strips, sheets, plates, and tubing, 7,281 (18,063) tons; and copper, old and scrap, 1,438 (964) tons.

Chile.—Production of copper in Chile dropped in 1945 but continued to be close to the peak rate for the war period. According to the annual report to stockholders of the Kennecott Copper Corp., the corporation was called upon during the year to increase wages, and the wage agreement carried a continuing obligation to vary wages in accordance with fluctutation in living costs. Living costs continued to advance in Chile, and a further increase in wages was granted. An ample supply of common labor was available during the year, but the shortage of technically trained men became critical. Legislation in Chile provided new social benefits in 1945, and taxes were raised. The subsidiary Braden Copper Co. mined and milled 8,693,296 short (7,886,400 metric) tons of ore having an average assay of 2.203 percent copper. Refined-copper output was 329,798,078 pounds (149,600 metric tons). In connection with the mine catastrophe in June, the company said:

> It is with deep regret that we report the death of 355 employees, resulting from an accident which occurred on the morning of June 19, 1945. The basic cause was a small fire which started in the car repair shop, a considerable distance from the mine workings. All employees were immediately ordered from the mine but before the instructions could be complied with a violent explosion of gases resulting from the burning of a small amount of lubricating oil forced a heavy concentration of carbon monoxide gas through many of the mine work-

ings. Strenuous efforts by the rescue squads to bring out and resuscitate the stricken men were of little avail, the toxic action of the gas being so swift and fatal. The origin of the fire is still being investigated by Chilean authorities.

The Chuquicamata mine of the Chile Exploration Co. and the Andes mine of the Andes Copper Mining Co., subsidiaries of the Anaconda Copper Mining Co., were also productive in 1945 and were also affected by increased costs. Both properties experienced labor strikes during the year. According to the Yearbook of the American Bureau of Metal Statistics for 1945, the former produced 261,929 (237,600 metric) and the latter 70,311 (63,800 metric) short tons of copper in 1945.

Exports of electrolytic copper totaled 233,284 metric tons in 1945, compared with 274,663 in 1944. In the remainder of the paragraph figures for 1944 are given in parentheses. Of the electrolytic exports in 1945, 209,431 (256,286) tons went to the United States, 10,061 (none) to Sweden, 9,891 (16,235) to Brazil, 1,999 (2) to Bolivia, 1,900 (2,040) to Argentina and 2 (none) to Ecuador. Of the exports of 198,630 (217,209) tons of standard (furnace refined), 183,511 (214,121) were shipped to the United States, 5,756 (none) to Italy, 2,827 (30) to Argentina, 2,439 (none) to Sweden, 2,158 (none) to Switzerland, 1,561 (2,811) to Brazil, and 378 (247) to Uruguay. Ore exports totaled 31,192 (20,811) tons, those of concentrate 7,520 (6,937) tons, and those of cement copper 16 (83) tons, all of which was destined to the United States.

Finland.—Production in Finland should increase markedly because capacity of the Outokumpu Copper Co. was recently enlarged by the construction of a modern smelting works at Harjavalta, according to the January 22, 1946, issue of the Metal Bulletin (London). The report said that former monthly output of not above 1,000 tons should be doubled. Copper refining is done at the Bjorneborg electrolytic plant, and this plant has been extended to accommodate the increased blister production. The concern also makes copper and brass alloys in sheets, tubes, bars, and other forms.

Germany.—Previous reports of this series have pointed out that the supply of copper, so needed to produce armaments, was a crucial problem in Germany because copper was one of the commodities in which Germany was seriously deficient; the shortage of copper doubtless contributed to the German defeat in 1945. Many figures have come out of Germany since the cessation of hostilities and some of the data are covered in the following discussion. The estimated average annual mine output of copper in 1940–44 was reported by the Metallgesellschaft as 25,200 metric tons (copper content). Production by smelters from ores and scrap for the same period averaged 41,200 tons and that by the refineries, from all sources, 169,000 tons. For 1944 alone the figures were estimated as 25,000, 30,000, and 180,000, respectively. Estimates included in another Metallgesellschaft report were that approximately 410,000 tons of copper, in the form of ores, concentrate, scrap material, unrefined, refined copper, and copper products, were available in Germany at the commencement of occupation by the Allies. Of the total, 50,000 tons were estimated to be in the American zone, 170,000 in the British, 10,000 in the French, and 180,000 in the Russian.

The Mansfeld operations, which include mining, smelting, refining, and fabricating facilities, suffered no war damage, and refining and fabricating plants at Ilsenburg were likewise unharmed by bombing. The Norddeutsche Affinerie and Zinnwerke Wilhelmsburg at Hamburg, according to current releases of the American Bureau of Metal Statistics, were seriously damaged but not irreparably so.

According to the Metal Bulletin (London) of April 19, 1946, Germany's annual production (capacity), based on current estimates, will be at a level of about 140,000 tons in 1949 contrasted with a prewar output (1936) of 292,000 tons.

Japan.—Estimates covering production, imports, exports, and consumption of copper in Japan were published [13] recently. Estimated production for Japan since 1937 was given as follows: 1938, 90,000 metric tons; 1939, 94,000; 1940, 104,000; 1941, 104,000; 1942, 104,000; and 1943, 123,000. The report states that the figures cover "Japan Proper" and later on says that—

> it is probable that all copper from Formosa and some from Korea and Manchuria are included.

Statistics showing refined-copper production, imports, exports, and consumption were recently made available in graphic form by General Headquarters of the Supreme Commander for the Allied Powers. As closely as the chart can be read, it appears that refined-copper output in 1938 was nearly 70,000 metric tons, in 1939 slightly over 70,000, in 1940 almost 100,000, in 1941 about 85,000, in 1942 nearly 105,000, in 1943 nearly 125,000, and in 1944 slightly below 100,000. The report gives no details as to what is covered by the figures on refined production, but they appear to include foreign as well as domestic copper. According to the first report mentioned, the copper industry in Japan is controlled largely by five powerful financial groups known as "Zaibatsu," namely, the Mitsubishi, Furukawa, Sumitomo Besshi, Fujita, and Nippon mining companies. These companies owned the mines, smelters, refineries, and, in most instances, their own fabricating plants. Mines that managed to continue operating are classified as 7 large, 5 medium-size, and 60 or more small ones. Most of the large and medium-size mines have been worked for many years and were reported to have been largely depleted of high-grade ores. They continued to contribute approximately 82 percent of the production, nonetheless.

Mexico.—Output of copper in Mexico rose sharply in 1945 to 61,680 metric tons from 41,302 tons in 1944. The 1945 production had been exceeded in only 5 years—1905, 1918, 1928, 1929, and 1930. The increase was due to the production from the "Low-Grade Project" of the Cananea Consolidated Copper Co., at Cananea, Sonora, where operation commenced September 1944. The Boleo mine at Santa Rosalia, Lower California, continued to produce in 1945, and the Oropeo Copper Co., in the State of Michoacan, began production in September.

According to the Yearbook of the American Bureau of Metal Statistics for 1945, Cobre de Mexico, S. A., expected to put an electro-

[13] Bureau of Mines, Foreign Minerals Survey, Mineral Resources of Japan: Vol. 2, No. 5, October 1945, p. 10.

lytic copper refinery, capable of producing 12,000 tons annually, into operation in Mexico, D. F., early in 1946.

Northern Rhodesia.—Statistics recently made available indicate that copper production reached a peak of 267,000 metric tons in 1940, dropped to 232,000 in 1941, rose to 255,000 in 1943, and declined thereafter to 196,000 in 1945. The United Kingdom was by far the chief destination of exports of Northern Rhodesian copper after the outbreak of World War II, through contracts that were terminated January 31, 1945. As the time for expiration of the contracts neared, producers were concerned regarding future markets for their product. It was soon learned that the United States could easily use additional metal in its huge armament program for 1945, and Rhodesian copper thus was scheduled to come here. The United States Foreign Economic Administration announced in April that the British had made available to the United States, under reverse Lend-Lease, 30,000 tons of Rhodesian copper in the first quarter of 1945 and had agreed to supply an additional 42,000 tons in the second quarter, of an original United States request for 175,000 tons for delivery from March to the end of the year. The majority of United States foreign copper purchase contracts were terminated October 31, but metal continued to arrive from Northern Rhodesia through December.

The following paragraphs on Rhodesia were abstracted from the respective company reports.

At the Roan Antelope mine, 2,622,710 short tons of ore, containing 2.63 percent copper, were mined in the fiscal year ended June 30, 1945, compared with 2,980,915 tons containing 2.74 percent in 1944. Ore reserves at the end of June 1945 totaled 102,458,330 tons, averaging 3.279 percent copper.

The Rhokana Corp., Ltd., produced 107,597 short tons of blister and electrolytic copper in the fiscal year ended June 30, 1945, compared with 113,951 tons in 1944. Of the 1945 total, 20,001 tons were Nkana blister, 17,976 tons Nchanga blister, and 69,620 tons Nkana electrolytic copper, compared with 25,227, 19,775, and 68,949 tons, respectively, in 1944. Ore reserves in the Nkana north ore body at the end of June 1945 totaled 23,748,600 short tons, containing 3.31 percent copper, of which 11,164,900 tons, averaging 3.23 percent, were partly developed, and 10,574,300 tons, averaging 3.32 percent, were undeveloped. The Nkana south ore body contained an undeveloped reserve of 19,614,000 short tons, averaging 2.77 percent copper. The reserve of 60,192,700 tons, averaging 3.70 percent copper, in the Mindola ore body contained 3,819,700 tons, averaging 4.56 percent, of partly developed ore and 51,700,000 tons, averaging 3.51 percent, of undeveloped ore.

The Nchanga Consolidated Copper Co. milled 476,300 short tons of ore, averaging 4.8 percent copper, that yielded 15,917 tons of copper in the fiscal year ended March 31, 1945. During the year under review a strike of European employees was called in November 1944 and lasted about 6 weeks, suspending production. A total of 18,140 tons of copper was produced in the 1944 fiscal year and 15,219 in 1943.

Mufulira Copper Mines produced 58,275 long (65,268 short) tons of blister copper in the fiscal year ended June 30, 1945, compared with a peak output of 85,523 (95,786) tons in the year ended June 30, 1942. Ore reserves at the Chambishi and Baluba properties were recalculated to be 138,678,000 short tons, averaging 3.84 per cent copper, on June 30, 1945.

Spain.—The Rio Tinto Co. is the principal producer of copper in Spain and has a production capacity of 8,000 metric tons [14] a year. The company is essentially a producer of iron pyrites which carries a varying copper content up to about 1.7 percent. The report indicates that Spain's annual copper requirements average 29,000 tons, indicating a large deficiency in supplies from domestic sources. According to Evan Bennett, minerals attaché at Madrid, figures on ore reserves are not released by the management of the company, but it is believed that 50,000,000 tons of 46+-percent pyrite are developed. About 5,000,000 tons of porphyry ore containing over 1.5 percent copper are available.

Turkey.—Production of blister copper amounted to 9,800 metric tons in 1945, compared with 11,404 in 1944. The mine at Ergani accounted for 9,544 tons in 1945 and 10,500 in 1944. The Kuvarshan mine near Murgul was closed during the second quarter of 1945, following exhaustion of known ore. Plans were made for completion of the new installation at Murgul, but it is not expected that this mine will be in operation before 1948. On January 1, 1945, the Government-controlled Turkish Copper Works, Ltd., was established by the Ministry of Economy to combine the operations of the existing copper mines in Turkey, to sell copper after it has been converted into blister or refined copper, and to exploit new copper mines. The mines were formerly operated as subsidiaries of the State bank, the Eti Bank; the new company is also under the general supervision of the Eti Bank.

United Kingdom.—At the outset of 1945, the United Kingdom was discontinuing purchases of copper, and contracts with Rhodesian and Canadian producers were terminated, the policy being to reduce large stocks of metal on hand. Rhodesian copper was released to the United States in 1945 under reverse Lend-Lease arrangements. By the end of the year, however, the British Government was again ready to buy large quantities of copper. Contracts were entered into with Rhodesian and Canadian producers to cover all copper not previously committed for the first 6 months of 1946. Some Chilean copper was even contracted for early in 1946. The general election, in which the Labor Party was returned by an overwhelming majority, was spoken of [15] as a disturbing factor in the market. Much progress was made during the year in freeing the nonferrous metals from wartime restrictions, but the Ministry of Supply remained the sole purchaser of raw materials from overseas for the trade. Stocks of virgin copper were reduced from 282,400 long tons at the beginning of 1945 to 123,100 tons at the end. Statistics showing consumption of copper in the United Kingdom were made available during the year.

[14] Bureau of Mines, Foreign Minerals Survey, Mineral Resources of Spain: Vol. 2, No. 1, May 1945, p. 11.
[15] Metal Industry, Base Metal Markets: Vol. 68, No. 1, January 4, 1946, p. 11.

Consumption of copper in fabricated products in the United Kingdom, 1942–45, in long tons [1]

[British Ministry of Supply; in tons of 2,240 pounds]

	1942	1943	1944	1945
Unalloyed:				
High-conductivity rods and strip	169, 721	155, 334	140, 906	139, 759
Rods and sections	5, 502	5, 088	5, 263	5, 364
Strip and sheet	34, 986	30, 549	28, 484	35, 237
Tubes	38, 072	35, 388	31, 202	25, 147
Castings	15, 987	12, 750	11, 200	8, 250
Total, unalloyed	264, 868	239, 109	217, 055	213, 757
Alloyed (chiefly brass):				
Wire	11, 371	11, 186	8, 976	8, 406
Rods and sections	137, 223	130, 193	98, 239	77, 174
Strip and sheet	293, 892	287, 412	185, 013	85, 669
Tubes	9, 465	12, 262	11, 109	8, 926
Castings	94, 422	104, 400	91, 300	54, 405
Total alloyed (copper content)	546, 373	545, 453	394, 637	234, 580
Copper sulfate (copper content)	8, 862	10, 815	11, 347	13, 194
Total, all products	820, 103	795, 377	623, 039	461, 531
Of which:				
Consumption of virgin copper	490, 772	448, 631	348, 139	288, 613
Consumption of scrap copper	329, 331	346, 746	274, 900	172, 918

[1] British Ministry of Supply, quoted in Yearbook of the American Bureau of Metal Statistics, 1945, p. 33.

Comparable statistics for earlier years are not available, but approximate estimates of the total consumption of virgin copper were 440,000 tons in 1940 and 445,000 in 1941.

Foreign trade figures were also released in 1945. Figures for the war period were as follows:

Copper imported into and exported from the United Kingdom, 1939–45, in long tons [1]

[In tons of 2,240 pounds]

	1939	1940	1941	1942	1943	1944	1945
IMPORTS							
Electrolytic	172, 087	278, 456	249, 056	231, 989	293, 624	242, 739	92, 068
Other unwrought	154, 257	195, 204	202, 382	209, 004	201, 165	218, 267	101, 217
Plates, sheets, strips, circles	1, 574	18	----------	78	479	29	3
Rods and wires not in coils	16, 139	32, 822	22, 901	12, 225	10, 405	3, 056	----------
Wire in coils	716	580	1	18	10, 275	309	103
Other manufactures	2, 274	1, 489	107	176	268	72	----------
EXPORTS							
Copper, unwrought	10, 407	3, 924	3, 552	278	112	387	5, 734
Plates, sheets, discs, etc.	3, 804	3, 570	3, 296	2, 411	1, 577	1, 675	3, 672
Wire in coils	9, 338	8, 350	9, 495	4, 214	2, 138	926	----------
Tubes	1, 046	1, 965	1, 605	877	698	1, 152	----------
Other manufactures	3, 597	2, 587	2, 999	1, 966	1, 137	1, 006	----------

[1] Yearbook of the American Bureau of Metal Statistics, 1945, p. 33.

United Kingdom copper prices were unchanged during 1945, despite considerable pressure to raise them; they were advanced early in 1946.

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LEAD [1]

By RICHARD H. MOTE

SUMMARY OUTLINE

GENERAL SUMMARY

Despite huge reductions in military requirements immediately following victory in both the European and Pacific phases of the war, the supply of lead available for industrial consumption throughout 1945 was seriously short of demand. Domestic mine production, the largest single source of supply, continued to decline. Imports of lead-bearing materials so urgently needed to offset the decreasing domestic mine output dropped to the lowest level since 1940. In contrast, however, the smelter production of secondary lead, always a substantial source of the heavy metal, increased 10 percent over the 1944 output. Consumption of refined lead, although 12 percent less than in 1944, continued at a high level, and to meet the demands for essential military and civilian uses monthly allocations were made from Government stocks of refined lead. As a result, the Government stock pile was reduced to 68,700 short tons at the end of 1945—slightly more than a month's supply at the average rate of consumption during the year.

Domestic mine production of recoverable lead, smallest of any year since 1938, declined 6 percent from the 1944 output. Refined primary lead production from domestic and foreign ores and base bullion decreased 5 percent in 1945. Stocks at primary refineries (physical inventory) more than doubled during 1945, while Government-owned stocks decreased 24 percent. Consumers' inventories recorded a 19-percent gain over 1944.

The established price of 6.50 cents a pound for lead at New York remained unchanged throughout 1945.

[1] This report deals primarily with the smelting, refining, and consuming phases of the industry. For full details of mining operations, see separate reports issued for the various States.

Salient statistics of the lead industry in the United States, 1925–29 (average) and 1941–45, in short tons

	1925–29 (average)	1941	1942	1943	1944	1945
Production of refined primary lead:						
From domestic ores and base bullion	660,525	470,517	467,367	406,544	394,443	356,535
From foreign ores and base bullion	123,104	100,450	99,472	63,068	70,320	87,050
	783,629	570,967	566,839	469,612	464,763	443,585
Recovery of secondary lead	280,000	397,416	323,001	342,094	331,416	363,039
Imports: [1]						
Lead in pigs, bars, and old	4,592	274,395	369,254	244,510	226,073	230,313
Lead in base bullion	95,747	24,704	43,855	4,583	58	8
Lead in ores and matte	40,096	82,115	79,362	70,023	93,570	70,005
Exports of refined pig lead	98,048	14,359	[2] 5,814	[2] 13,261	[2] 15,523	[2] 1,784
Lead remaining in bonded warehouse at end of period	136,969	156,286	(3)	(3)	(3)	(3)
Refined primary lead apparently shipped to domestic consumers	690,916	812,863	669,840	777,661	775,095	670,122
Estimated consumption of primary and secondary lead	900,250	1,050,000	1,043,000	1,113,000	[4] 1,118,643	1,051,602
Prices:						
New York:						
Average for year ... cents per pound	7.47	5.79	6.48	6.50	6.50	6.50
Quotation at end of year ... do	6.25	5.85	6.50	6.50	6.50	6.50
London average ... do	5.87	4.49	4.49	4.49	4.49	4.99
Mine production of recoverable lead	664,230	461,426	496,239	453,313	416,861	390,831
World smelter production of lead	1,850,000	(3)	(3)	(3)	(3)	(3)

[1] Data include lead imported for immediate consumption plus material entering the country under bond.
[2] Includes 3,874 tons of foreign lead reexported in 1942, 11,258 tons in 1943, less than 1 ton in 1944, and 377 tons in 1945, according to records of the U. S. Department of Commerce.
[3] Data not available.
[4] Revised figure.

Figure 1 shows trends in the domestic lead industry since 1900.

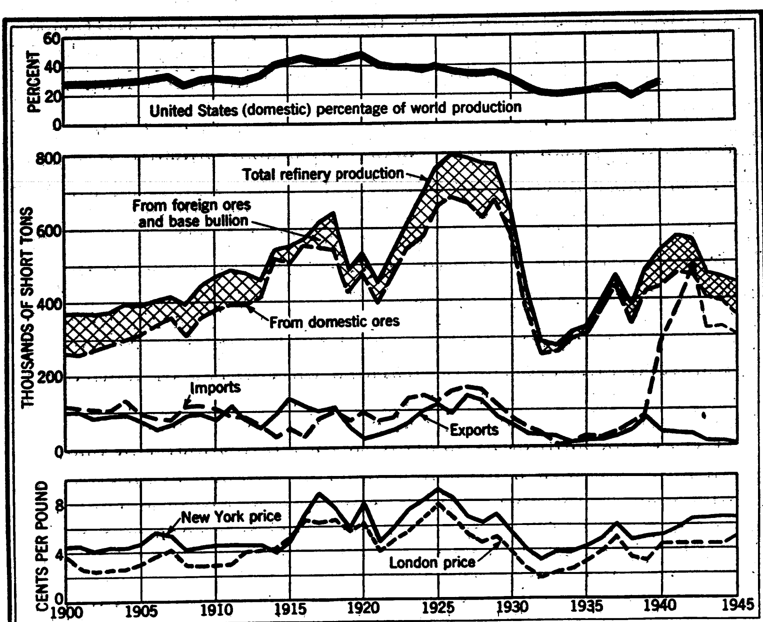

FIGURE 1.—Trends in the lead industry in the United States, 1900–1945. Imports include lead in ore, base bullion, pig lead, and scrap; exports include pigs, bars, and scrap lead exported in manufactures with benefit of draw-back. Data on lead exported in manufactures with benefit of draw-back not available for 1945

GOVERNMENT REGULATIONS

Lead continued under Government control during 1945, through the provisions of War Production Board General Preference Order M-38. In operation, the order prohibited use of lead for certain purposes and permitted all essential uses to function free of control Facing a critical supply position late in 1944, the WPB amended Order M-38, effective December 26. Under the revised order, the use of lead for most civilian applications was restricted to 60 percent of the 1944 level of consumption. The order contained three lists pertaining to the restriction and availability of lead: The first group, "A," banned the use of lead in certain civilian items; group "B" covered military uses, storage batteries, cable covering, tetraethyl lead, ammunition, and a few nonmilitary uses, such as solders, bearing metals, and brass and bronze, for which lead would be available without restrictions; and group "C," which contained the civilian items restricted to 60 percent of the 1944 consumption. Greater restrictions were placed on other than essential uses in an amendment to the order on January 15, 1945. A second amendment on February 1 increased the allowable use of lead in storage batteries for civilian use from 30 percent of the 1944 base period to 37.5 percent. The order was again amended, effective March 31, when a list of 64 permissible uses was substituted for the previous lists A, B, and C, which covered restricted uses, unrestricted uses, and quota percentage restrictions.

Government control over lead was extended on February 14 to imports of three important manufactured items when WPB General Imports Order M-63 was amended banning the importation by private purchasers of collapsible lead tubes, storage batteries, and lead foil. Later in April a subsequent amendment included lead disks, slugs, and other semifabricated forms in which lead is a component part.

As a result of cut-backs in military requirements, lead quotas for several manufactured articles were increased during the summer months. Storage-battery manufacturers were permitted an increase to 25 percent of the 1944 usage during the third quarter of 1945. A similar increase in the quota was permitted in the preparation of collapsible lead tubes. In late July, the WPB, because of increasing stocks, removed lead from the critical materials list and placed it on a list of products still under surveillance. Prompted further by the improved statistical position of lead during early August, the WPB removed entirely the limitations on the use of lead chemicals for rubber compounding and gasoline refining. The production of white and red lead was permitted a moderate increase.

Belief that the ending of hostilities had improved the lead supply situation enjoyed only a brief existence, however. The Government stock pile was dwindling rapidly, and it was obvious that reserves would soon be exhausted unless consumption was again restricted. Accordingly, on December 18 the Civilian Production Administration (successor November 3 to the WPB) announced a reduction in allocations for the first quarter of 1946 to producers of automobile batteries and tetraethyl lead. Quotas for the manufacture of industrial-type batteries, cable coverings, and collapsible tubes were unchanged.

Subsidy payments under the Premium Price Plan for overquota production were continued throughout 1945. A brief outline of the Premium Price Plan and an accompanying table giving production and payments from 1942 through 1945 are given in this chapter under Prices.

RECIPROCAL TRADE AGREEMENTS

On June 19, 1945, the Senate passed a bill (H. R. 2652) extending the Reciprocal Trade Agreements Act for 3 years and permitting as much as a 50-percent reduction in the rates of duty prevailing on January 1, 1945. The bill further provided that any temporary reduction under wartime agreements should remain temporary, however, and any cut in the duty should be with respect to the rates established by the 1930 tariff act. Under the "most-favored-nation" policy, any reduction embodied in a reciprocal agreement would apply equally to virtually all countries.

In accordance with the Mexican Trade Agreement of January 30, 1943, the tariff on lead-bearing ores, flue dust, and mattes remained at ¾ cent per pound (lead content) and lead bullion, pigs, bars, scrap lead, etc., 1$\frac{1}{16}$ cents per pound during 1945. A provision of the agreement permits the increase in the tariff on lead-bearing ores, flue dust, and mattes to 1½ cents per pound (lead content), and lead bullion, pigs, bars, scrap lead, etc., to 1$\frac{7}{10}$ cents per pound, 30 days after the war emergency is officially terminated.

DOMESTIC PRODUCTION

Statistics on lead output may be prepared on a mine or smelter and refinery basis. The mine-production data compiled on the basis of lead content in ore and concentrates and adjusted to account for average losses in smelting are the most accurate measure of production from year to year. The pig-lead output, as reported by smelters and refiners, presents a more precise figure of actual lead recovery but generally differs from the mine figure due to the overlap or lag between mine shipments and smelter receipts of ore and concentrates. These inequities, however, tend to balance over a period of years.

MINE PRODUCTION

The mine production of recoverable lead (including that made into pigments) from domestic mines in the United States and Alaska decreased 6 percent in 1945, was 21 percent under the war-period peak in 1942, and was 41 percent below the average production in the period 1925 through 1929. The domestic lead production comes principally from three areas—Southeastern Missouri; the Tri-State area (Joplin region), embracing Southwestern Missouri, Southeastern Kansas, and Northeastern Oklahoma; and the Western States (principally Idaho, Utah, Arizona, Colorado, and Montana). Of the total produced in the United States, approximately 66 percent came from the output of a relatively small number of mines, each of which produced over 4,000 tons of recovered lead in 1945. Missouri again ranked first in the production of lead, and the Southeastern Missouri district continued to be the largest lead-producing area, supplying 44 percent of the total domestic output. The four mines of the St. Joseph Lead Co. continued, as in the past, to produce the bulk of the output from this district. The Tri-State area produced 6 percent of the total domestic output in 1945 compared with 7 percent in 1944. The Western States contributed 47 percent of the total domestic production despite a decline of 12 percent from 1944. Idaho continued to be the largest producer of lead in the Western States and second largest in the United States, notwithstanding a production decline of 18 percent and the smallest output of any year since 1899. Nearly 93 percent of the State total lead came from the Coeur d'Alene region. Five properties in Idaho produced 51 percent of the State total lead, and of the total 81 percent came from zinc-lead ore and old tailings from the Coeur d'Alene region. Although lead output in Utah, the lowest since 1899, dropped 22 percent below the 1944 production, the State continued to rank second among the Western States. In spite of a decrease of over 7,000 tons from the 1944 output, the United States and Lark property in the West Mountain (Bingham) district, operated by the United States Smelting, Refining & Mining Co., remained by far the largest producer of lead in Utah. About 85 percent of the State total lead was recovered from zinc-lead ore. Lead production in Arizona was the largest in any year in the history of the State and 37 percent greater than in 1944. The Copper Queen mine of the Phelps Dodge Corp. at Bisbee was the largest Arizona lead producer in 1945; about 91 percent of the total lead was recovered from zinc-lead ore. Colorado production decreased 4 percent; the California (Leadville) district continued to be the largest lead-

Mine production of recoverable lead in the United States, 1925–29 (average) and 1941–45, by States, in short tons

State	1925–29 (average)	1941	1942	1943	1944	1945
Western States and Alaska:						
Alaska	982	662	415	200	44	11
Arizona	9,743	15,638	14,772	13,727	16,707	22,867
California	2,070	3,464	5,151	5,820	5,682	7,224
Colorado	30,112	12,574	15,181	18,032	17,698	17,044
Idaho	141,610	104,914	113,909	97,457	83,530	68,447
Montana	18,871	21,259	20,050	16,324	13,105	9,999
Nevada	9,807	9,623	5,376	4,790	6,605	6,275
New Mexico	6,730	4,668	4,608	5,723	7,265	7,662
Oregon	6	59	23	4	4	1
South Dakota	21	----------	85	41	34	----------
Texas	213	186	181	13	----------	----------
Utah	149,509	69,601	71,930	65,257	52,519	40,817
Washington	1,323	3,903	4,851	5,022	5,825	3,802
Wyoming	----------	----------	3	----------	----------	3
	370,997	246,551	256,535	231,410	209,018	184,152
Central States:						
Arkansas	38	11	2	1	----------	1
Illinois	552	2,376	2,344	2,043	1,971	3,005
Kansas	26,121	14,538	9,419	9,213	9,394	7,370
Kentucky	135	282	335	240	170	129
Missouri	202,240	165,909	199,548	184,910	174,683	176,575
Oklahoma	58,306	25,021	22,806	19,733	13,944	12,664
Wisconsin	1,745	1,225	775	920	1,415	1,776
	289,137	209,362	235,229	217,060	201,577	201,520
Eastern States:						
New York	----------	2,100	2,434	2,355	1,644	862
Tennessee	250	23	238	200	----------	54
Virginia	3,846	3,390	1,803	2,288	4,622	4,243
	4,096	5,513	4,475	4,843	6,266	5,159
	664,230	461,426	496,239	453,313	416,861	390,831

producing area in the State. Zinc-lead ore yielded 64 percent of the State total in 1945.

Detailed information on the production of mines and districts in the United States may be found in the chapters of this volume dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

Mine production of recoverable lead in the United States, by districts that produced 1,000 tons or more during any year, 1941–45, in short tons

District	State	1941	1942	1943	1944	1945
Southeastern Missouri region	Missouri	164,342	197,291	179,012	169,622	173,005
Coeur d'Alene region	Idaho	95,529	106,474	89,813	76,813	63,430
Tri-State (Joplin region)	Kansas, Southwestern Missouri, Oklahoma.	41,080	34,341	34,722	28,059	23,556
West Mountain (Bingham)	Utah	34,512	39,996	35,437	31,169	22,723
Warren (Bisbee)	Arizona	970	813	712	3,497	9,400
Park City region	Utah	19,094	15,278	16,022	11,660	8,916
Central	New Mexico	3,902	3,206	3,571	4,428	5,379
Old Hat	Arizona	2,172	1,801	3,140	4,161	5,216
Coso	California	[1] 11	755	2,448	2,609	5,214
California (Leadville)	Colorado	1,112	3,348	4,950	5,752	5,016
Tintic	Utah	9,424	10,176	8,261	5,319	4,930
Austinville	Virginia	3,390	1,661	1,760	4,235	4,222
Metaline	Washington	3,819	4,553	4,581	5,278	3,506
Heddleston	Montana	967	2,290	2,350	2,436	3,175
Rush Valley	Utah	4,168	3,988	3,505	3,293	3,137
Pioche	Nevada	6,822	2,764	2,942	4,056	2,987
Summit Valley (Butte)	Montana	8,630	7,206	3,290	3,251	2,870
Kentucky-Southern Illinois	Kentucky, Southern Illinois	2,538	2,546	2,199	2,048	2,649
Animas	Colorado	3,045	2,124	2,657	2,236	2,613
Pioneer (Rico)	do	2,525	2,282	2,566	2,826	2,440
Warm Springs	Idaho	5,334	3,783	3,635	3,333	2,347
Upper Mississippi Valley	Iowa, Northern Illinois, Wisconsin.	1,345	908	1,004	1,508	2,261
Pima (Sierritas, Papago, Twin Buttes).	Arizona	4	11	578	2,445	2,063
Upper San Miguel	Colorado	1,408	1,716	2,074	1,442	1,986
Big Bug	Arizona	594	953	1,145	1,244	1,981
Bayhorse	Idaho	1,378	1,644	1,481	[1] 2,069	1,302
Magdalena	New Mexico	424	864	1,320	1,620	1,243
Resting Springs	California	2,581	4,044	2,938	1,800	1,192
Harshaw	Arizona	5,541	6,132	3,496	2,212	1,066
St. Lawrence County	New York	2,100	2,434	2,355	1,644	862
Wallapai	Arizona	2,408	1,656	1,392	784	752
Eagle	Montana	3,294	1,999	1,580	1,128	599
Red Cliff	Colorado	1,710	2,240	1,761	1,444	572
Montana	Montana	1,601	1,025	509	569	438
Smelter (Lewis and Clark County).	do	1,527	1,988	2,389	1,364	223
Ophir	Utah	1,437	1,623	1,461	365	115
Port Hill	Idaho	1,537	1,044	316	15	61
Barker	Montana	22	1,712	1,633	56	57
Hog Heaven	do	2,824	614	-------	1	-------

[1] Corrected figure.

SMELTER AND REFINERY PRODUCTION

The production of pig lead in the United States is derived from 3 main sources—domestic mine production, imports of foreign ore and base bullion, and secondary smelter production from scrap material—and is produced at primary plants that treat ore, base bullion, and small quantities of scrap and at secondary plants that process scrap exclusively. Of the 8 primary smelters operating in the Western States, only two (Selby, Calif., and Bradley, Idaho) produce refined merchant lead. The other 6 plants produce only base bullion (containing approximately 98 percent lead plus gold, silver, and small quantities of impurities recovered from the ore smelted), which is shipped to refineries in the Middle Western and Eastern States for recovery of the gold and silver and purification of the lead to meet commercial requirements. Both primary and secondary smelting plants may make refined lead or antimonial lead. Because of the large quantity of hard lead—such as battery scrap—melted at secondary smelters, the output from this type of operation is essentially antimonial lead alloys. Statistics on the production of refined lead and alloys at secondary plants are given in the section of this chapter on Secondary Lead. The 16 primary smelters and refineries in operation in the United States in 1945 consumed 454,778 short tons (lead content) of ore, 19 percent of which was mined in foreign countries, compared with 477,765 tons in 1944, 15 percent of which was foreign ore.

ACTIVE LEAD SMELTERS AND REFINERIES

A list of primary lead smelters and refineries operating in the United States in 1945 follows:

California: Selby—Selby plant, American Smelting & Refining Co. (smelter and refinery).
Colorado: Leadville—Arkansas Valley plant, American Smelting & Refining Co. (smelter).
Idaho: Bradley—Bunker Hill Smelter (smelter and refinery).
Illinois: Alton—Federal plant, American Smelting & Refining Co. (smelter and refinery).
Indiana:
- East Chicago—International Smelting & Refining Co. (refinery).
- East Chicago—U. S. S. Lead Refinery, Inc. (refinery).

Kansas: Galena—Galena plant, Eagle-Picher Co. (smelter and refinery).
Missouri: Herculaneum—Herculaneum plant, St. Joseph Lead Co. (smelter and refinery).
Montana: East Helena—East Helena plant, American Smelting & Refining Co. (smelter).
Nebraska: Omaha—Omaha plant, American Smelting & Refining Co. (refinery).
New Jersey:
- Barber—Perth Amboy plant, American Smelting & Refining Co. (smelter and refinery).
- Carteret—United States Metals Refining Co. (refinery).

Texas: El Paso—El Paso plant, American Smelting & Refining Co. (smelter).
Utah:
- Midvale—United States Smelting, Refining & Mining Co. (smelter).
- Murray—Murray plant, American Smelting & Refining Co. (smelter).
- Tooele—Tooele plant, International Smelting & Refining Co. (smelter).

REFINED LEAD

Primary refineries in the United States in 1945 produced 462,110 short tons of refined lead, a decline of 3 percent from the 1944 output of 476,131 tons.

Of the 443,585 tons of primary lead produced in 1945, domestic ores and base bullion supplied 80 percent, and 20 percent was derived from foreign ores and imported base bullion. In 1944 the origin was 85 percent domestic and 15 percent foreign. The quantity of refined lead produced from foreign base bullion has been negligible since 1943. The following tables give the production of refined lead by sources and by country of origin of the ore. Details of the sources of lead from domestic ores are given in the section of this chapter on Mine Production.

Refined lead produced at primary refineries in the United States, by sources, 1941–45, in short tons

Source	1941	1942	1943	1944	1945
Refined lead:					
From domestic ores and base bullion	470, 517	467, 367	406, 544	394, 443	356, 535
From foreign ores	74, 166	81, 485	62, 936	70, 225	86, 932
From foreign base bullion	26, 284	17, 987	132	95	118
Total from primary sources	570, 967	566, 839	469, 612	464, 763	443, 585
From scrap	13, 454	12, 856	1, 863	11, 368	18, 525
Total refined lead	584, 421	579, 695	471, 475	476, 131	462, 110
Average sales price per pound	$0. 057	$0. 063	$0. 064	$0. 064	$0. 064
Total calculated value of primary refined lead [1]	$65, 090, 000	$71, 422, 000	$60, 110, 000	$59, 490, 000	$56, 778, 880

[1] Excludes value of refined lead produced from scrap at primary refineries.

Refined primary lead produced in the United States, by country of origin, 1941–45, in short tons

Source	1941	1942	1943	1944	1945
Domestic ore and base bullion	470, 517	467, 367	406, 544	394, 443	356, 535
Foreign ore:					
Australia	19, 561	19, 638	16, 180	22, 210	22, 087
Canada	5, 708	5, 980	4, 537	7, 461	11, 151
Europe	123	14			
Mexico	390	2, 403	2, 213	5, 250	3, 097
South America	27, 173	23, 127	9, 610	13, 434	25, 701
Other foreign	21, 211	30, 323	30, 396	21, 870	24, 896
	74, 166	81, 485	62, 936	70, 225	86, 932
Foreign base bullion:					
Australia	831	16, 902			
Mexico	25, 358	111	60	58	63
South America	47	216	72	37	55
Other foreign	48	758			
	26, 284	17, 987	132	95	118
Total foreign	100, 450	99, 472	63, 068	70, 320	87, 050
Grand total	570, 967	566, 839	469, 612	464, 763	443, 585

ANTIMONIAL LEAD

Antimonial lead production at primary refineries decreased 2 percent to 56,495 tons in 1945. The distribution of the lead, according to source, is shown in the following table. The quantity of antimony contained in antimonial lead produced in 1945 dropped to 7.3 percent owing to a greater demand for low-percentage alloys for use in the

Antimonial lead produced at primary lead refineries in the United States, 1941–45

Year	Production (short tons)	Antimony content		Lead content by difference (short tons)			
		Short tons	Percent	From domestic ore	From foreign ore	From scrap	Total
1941	40, 237	3, 510	8. 7	14, 852	8, 013	13, 862	36, 727
1942	51, 762	3, 524	6. 8	24, 512	12, 165	11, 561	48, 238
1943	63, 515	3, 371	5. 3	16, 674	10, 583	32, 887	60, 144
1944	57, 902	4, 670	8. 1	13, 280	5, 477	34, 475	53, 232
1945	56, 495	4, 148	7. 3	7, 286	2, 695	42, 366	52, 347

manufacture of such items as type metal, solder, sheet and pipe, and collapsible tubes and foil. Although antimonial lead is an important byproduct of the refining of base bullion, the quantity derived from this source is only a small part of the annual domestic output. The major production is recovered from the smelting of antimonial lead scrap at secondary smelters. Production data from lead-smelting plants treating scrap materials exclusively are summarized in the following section and discussed in detail in the chapter on Secondary Metals—Nonferrous.

SECONDARY LEAD

Some scrap lead is treated at primary smelters and refineries, but the greater part is received at a large number of plants that treat secondary materials exclusively. Secondary lead is recovered in the form of refined lead, antimonial lead, and other alloys. Recovery at primary and other plants in 1944 and 1945 is shown in the following table. Secondary lead recovered in 1945 was 10 percent greater than in 1944 and was equivalent to 82 percent of the total refined primary lead produced in the United States. Further details appear in the chapter on Secondary Metals—Nonferrous.

Secondary lead recovered in the United States, 1944–45, in short tons

	1944	1945
As refined metal:		
At primary plants	11,368	18,525
At other plants	43,678	42,598
	55,046	61,123
In antimonial lead:		
At primary plants	34,475	42,366
At other plants	146,343	151,713
	180,818	194,079
In other alloys	95,552	107,837
Grand total:		
Short tons	331,416	363,039
Value	$42,421,248	$46,468,992

LEAD PIGMENTS

The principal lead pigments are litharge, white lead, red lead, sublimed lead, leaded zinc oxide, and orange mineral. These products are manufactured for the most part from metal, but some ore and concentrates are converted directly to pigments. Details of the production of lead pigments are given in the chapter on Lead and Zinc Pigments and Zinc Salts.

STOCKS

Producers' stocks.—Lead stocks, as reported by the American Bureau of Metal Statistics, are shown in the following table. Stocks of refined and antimonial lead include metal held by all primary refiners and by some of the refiners of secondary material who produce soft lead, plus foreign lead smelted and refined in the United States and entered for domestic consumption. According to the monthly reports released by the American Bureau of Metal Statistics, stocks of refined lead and antimonial lead increased erratically from a low of 19,536 tons in January to 38,128 tons at the end of May, followed by alternating decreases and increases each month through September. From 36,514 tons on hand at the end of September, stocks advanced to a year-end total of 43,746 tons, high point for 1945, and a net gain of 124 percent from January 1.

Lead stocks at end of year at smelters and refineries in the United States, 1941–45, in short tons

	1941	1942	1943	1944	1945
Refined pig lead	15,973	28,815	28,821	15,602	35,853
Antimonial lead	4,212	6,122	4,269	3,934	7,893
	20,185	34,937	33,090	19,536	43,746
Lead in base bullion—					
At smelters and refineries	8,594	7,359	8,640	7,333	8,618
In transit to refineries	2,215	1,706	3,112	3,331	4,889
In process at refineries	17,709	13,925	16,020	14,473	15,097
	28,518	22,990	27,772	25,137	28,604
Lead in ore and matte and in process at smelters	51,446	59,247	68,678	80,461	89,462
	100,149	117,174	129,540	125,134	161,812

The Bureau of Mines annual survey of primary lead smelters and refiners indicated stocks of 16,788 tons (lead content) of refined lead at plants on January 1, 1945, and 37,690 tons on December 31, 1945. Primary antimonial lead stocks at these same plants increased from 3,387 short tons (lead content) at the beginning of 1945 to 6,773 tons at the end of the year. In terms of lead content, stocks of ore at the 16 operating smelters and refineries decreased 2 percent from 60,480 tons to 59,095 tons during the same period. The inventory of base bullion at refineries that receive base bullion as a raw material and at smelters that produce base bullion for shipment to refineries totaled 6,066 tons at the beginning of January and 7,125 tons at the end of December 1945. Stocks of "in-process" base bullion or work lead at 5 combination smelter-refinery plants are not included in reports to the Bureau of Mines. No direct comparison can be made between these data and the figures of the American Bureau of Metal Statistics. Figures reported to the Bureau of Mines represent physical inventory at the plants, irrespective of ownership, and do not include material in process or in transit.

Consumers' stocks.—Approximately 570 consumer plants reported stocks of 103,214 tons of domestic and foreign refined lead on hand December 31, 1945, a 19-percent increase over the 86,908-ton inventory (revised figure) reported at the end of 1944.

Government stocks.—Industry-owned stocks were augmented by a supply of Government-owned lead stored at strategic points throughout the United States for allocation to consumers as needed. According to reports submitted to the Civilian Production Administration (successor November 3 to the War Production Board), Government stocks of refined lead, mostly of corroding grade and from foreign sources, was 68,700 short tons on December 31, 1945, compared with 90,454 tons of refined lead on January 1, 1945.

Consumers' stocks of refined soft lead at the end of 1944 and 1945, by grades, in short tons

	Domestic and foreign					Foreign (all grades)
	Corroding	Chemical	Common	Other	Total	
Dec. 31, 1944 [1]	28,028	12,965	42,863	3,052	86,908	9,730
Dec. 31, 1945	32,395	21,520	47,735	1,564	103,214	6,692

[1] Revised figures.

DOMESTIC CONSUMPTION

A survey of 570 plants in 1945 representing an estimated 90 percent of the consumers of refined lead indicated a total consumption of 637,499 short tons of refined lead, a decrease of 12 percent from 1944. Some secondary as well as primary refined lead is included in this figure. Antimonial lead, unrefined scrap lead, and lead in alloys are excluded. Of the total consumed, 25 percent was used for making red lead and litharge, 14 percent for cable covering, 12 percent for tetraethyl fluid, 9 percent for storage batteries, 5 percent for white lead, 5 percent for sheet lead, 5 percent for ammunition, and the remaining 25 percent for a variety of products and uses shown in the accompanying table. A distribution of the total consumed by related uses indicates 49 percent consumed for metallic products, 30 percent for pigments, 13 percent in chemical products, and 8 percent in miscellaneous uses, such as annealing, galvanizing, lead plating, weights, and ballast.

Reports to the CPA indicate a consumption of 1,051,602 tons of primary, antimonial, and secondary lead in 1945 compared with 1,118,643 tons in 1944.

Consumption of refined lead in the United States, 1941–45, by uses, in short tons

	1941	1942	1943	1944	1945
Ammunition	32,959	48,025	64,023	31,479	29,315
Bearing metals	10,160	8,466	10,189	15,941	14,104
Brass and bronze	(1)	5,294	5,748	7,845	7,069
Cable covering	141,161	128,535	117,802	110,417	86,158
Calking lead	32,380	9,047	8,618	9,411	13,374
Casting metals	9,243	3,106	3,072	4,425	5,322
Collapsible tubes	3,726	9,966	11,425	12,482	7,428
Foil	51,516	9,359	5,816	11,190	2,185
Pipe, traps, and bends	32,946	21,411	18,724	24,387	24,061
Sheet lead	35,480	31,700	27,738	31,546	30,624
Solder	35,630	13,371	15,472	22,390	27,475
Storage batteries	73,982	62,604	68,239	68,769	60,179
Terneplate	2,069	2,336	815	2,190	2,178
Type metals	2,975	943	812	1,269	1,401
White lead	83,230	56,476	36,809	54,333	35,611
Red lead and litharge	143,496	100,563	124,715	157,080	157,171
Tetraethyl lead	48,327	50,152	65,320	83,067	75,890
Chemicals and insecticides	8,861	6,298	8,172	10,703	8,567
Annealing	(1)	5,229	5,987	5,719	5,525
Galvanizing	(1)	484	819	1,073	988
Lead plating	(1)	(1)	941	494	1,130
Weights and ballast	(1)	(1)	9,269	22,964	9,539
Other	64,506	33,746	64,940	33,646	32,205
Total	812,647	607,111	675,465	722,820	637,499

[1] Included under "Other."

The following table shows the calculated apparent shipments of refined primary lead to domestic consumers. The apparent shipments of 670,122 tons in 1945 are probably more nearly correct than the actual receipts of 653,805 tons reported by consumers, because of incomplete coverage of the survey.

Apparent shipments of refined primary pig lead to domestic consumers, 1941–45, in short tons

	1941	1942	1943	1944	1945
Supply:					
Stocks at primary refineries on Jan. 1	(1)	[2] 12,000	39,255	36,464	16,788
Government-owned stocks on Jan. 1 [3]		17,934	248,361	173,875	90,454
Production	570,967	566,839	469,612	464,763	443,585
Imports	274,189	366,497	244,033	222,758	227,469
Total available	845,156	963,270	1,001,261	897,860	778,296
Withdrawn:					
Stocks at primary refineries on Dec. 31	(1)	39,255	36,464	16,788	37,690
Government-owned stocks on Dec. 31 [3]	17,934	248,361	173,875	90,454	68,700
Exports	14,359	[4] 5,814	[4] 13,261	[4] 15,523	[4] 1,784
Total withdrawn	32,293	293,430	223,600	122,765	108,174
Apparent shipments to domestic consumers	812,863	669,840	777,661	775,095	670,122

[1] Official figures not available.
[2] Estimate based upon American Bureau of Metal Statistics data.
[3] According to reports submitted to the Tin-Lead-Zinc Division of the CPA.
[4] Includes 3,874 tons of foreign refined lead reexported in 1942, 11,258 tons in 1943, less than 1 ton in 1944, and 377 tons in 1945, according to records of the U. S. Department of Commerce.

PRICES

The two major markets for lead in the United States are New York and St. Louis; much of the lead produced domestically is sold at prices normally based upon quotations in these markets. Since suspension of trading on the London Metal Exchange in September 1939 the London market has had no direct influence on New York quotations, and the differential between St. Louis and New York prices has remained at 0.15 cent a pound, an amount approximating the freight charges between the two points.

The ceiling price for common lead—6.35 cents a pound, St. Louis, and 6.50 cents, New York—remained unchanged throughout 1945. The average price received by the primary producers for all grades of refined lead (excluding antimonial lead) sold remained at 6.4 cents a pound, f. o. b. plant. The 1945 price of 8.6 cents a pound for lead which appears in the separate State chapters represents the weighted average price received for all grades of refined lead (6.4 cents) plus the increment—in terms of cents per pound based upon the total domestic mine output of recoverable lead—of $17,429,467 in subsidies for overquota production and special mine contracts paid by the Office of Metals Reserve (successor July 1, 1945, to the Metals Reserve Company).

The general policy of the Quota Committee pertaining to the Premium Price Plan for overquota mine production of domestic lead (copper and zinc were also included) prevailed throughout 1945. The original plan in force since February 1, 1942, was operative only until July 31, 1945. Congress voted the Hayden-McFarland Bill, S–502, into Public Law 88 on June 14, 1945, extending the Plan until June 30, 1946. A compilation of important data showing production of lead under the Premium Price Plan since February 1942, at the various quota levels and the payments made, is given in the following table.

Salient statistics on lead with regard to the operation of the Premium Price Plan, 1942–45 [1]

	1942 [2]			1943			1944			1945 [3]		
	Tri-State district	United States exclusive of Tri-State	United States total	Tri-State district	United States exclusive of Tri-State	United States total	Tri-State district	United States exclusive of Tri-State	United States total	Tri-State district	United States exclusive of Tri-State	United States total
Total production of recoverable lead [4] ... short tons	30,746	416,310	447,056	34,830	409,170	444,000	28,956	381,060	410,016	23,097	367,734	390,831
Ceiling production at 6.50 cents a pound ... do	10,811	358,447	369,258	1,863	294,001	295,864	3,138	200,619	203,757	1,164	146,791	147,955
Percent of ceiling production to total production ... percent	35.16	86.10	82.60	5.35	71.85	66.64	10.84	52.65	49.69	5.04	39.92	37.86
Production under Premium Price Plan:												
"A" quota only (9.25 cents a pound) ... short tons	19,700	56,321	76,021	26,259	83,023	109,282	19,494	142,925	162,419	13,009	155,566	168,575
"B" quota (12.00 cents a pound) ... do	235	1,542	1,777	6,514	32,146	38,660	5,633	37,516	43,149	8,159	65,377	73,536
Total premium production ... do	19,935	57,863	77,798	32,773	115,169	147,942	25,127	180,441	205,568	21,168	220,943	242,111
Metals Reserve mine contracts ... do				194		194	691		691	765		765
Total overceiling production ... do	19,935	57,863	77,798	32,967	115,169	148,136	25,818	180,441	206,259	21,933	220,943	242,876
Percentage of overceiling production to total:												
Production under Premium Price Plan:												
"A" quota only ... percent	64.07	13.53	17.00	75.39	20.29	24.61	67.32	37.51	39.61	56.32	42.30	43.13
"B" quota (also received "A") ... do	.77	.37	.40	18.70	7.86	8.71	19.45	9.84	10.53	35.33	17.78	18.82
Total premium production ... do	64.84	13.90	17.40	94.09	28.15	33.32	86.77	47.35	50.14	91.65	60.08	61.95
Metals Reserve mine contracts ... do				.56		.04	2.39		.17	3.31		.19
Total overceiling production ... do	64.84	13.90	17.40	94.65	28.15	33.36	89.16	47.35	50.31	94.96	60.08	62.14
Payments under Premium Price Plan: [5]												
"A" premium ... dollars	1,096,435	3,182,450	4,278,885	1,802,497	6,334,273	8,136,770	1,381,983	9,924,261	11,306,244	1,164,240	12,151,860	13,316,100
"B" premium ... do	12,910	84,789	97,699	358,279	1,768,050	2,126,329	309,813	2,063,364	2,373,177	448,722	3,595,711	4,044,433
Total premium production ... do	1,109,345	3,267,239	4,376,584	2,160,776	8,102,323	10,263,099	1,691,796	11,987,625	13,679,421	1,612,962	15,747,571	17,360,533
Metals Reserve mine contracts [5] ... do				16,127		16,127	66,394		66,394	68,934		68,934
Total overceiling payments ... do	1,109,345	3,267,239	4,376,584	2,176,903	8,102,323	10,279,226	1,758,190	11,987,625	13,745,815	1,681,896	15,747,571	17,429,467
Average prices per pound of lead: [6]												
Average premium production ... cents	9.282	9.323	9.313	9.797	10.018	9.969	9.866	9.822	9.827	10.310	10.064	10.085
Metals Reserve mine contracts ... do				10.651		10.651	11.307		11.307	11.005		11.005
Total overceiling production ... do	9.282	9.323	9.313	9.802	10.018	9.970	9.905	9.822	9.832	10.334	10.064	10.088
Total production ... do	8.304	6.892	6.989	9.625	7.490	7.658	9.536	8.073	8.176	10.141	8.641	8.730

1 Compiled from a report of the Office of Price Administration. Data subject to revision.
2 Premium Price Plan effective February 1, 1942; data refer to February–December, inclusive.
3 Preliminary figures from the OPA.
4 Production of Tri-State lead from Office of Metals Reserve, Joplin, Mo., all other from Bureau of Mines monthly reports. These data are preliminary and do not exactly equal final annual totals for the United States except for 1945.
5 Data on premium payments and Metals Reserve mine-contract payments from Office of Metals Reserve. All payments shown are subject to correction due to additional payments as a result of retroactive quota adjustments, late reports by smelters and custom mills, etc.
6 All average prices shown include OPA ceiling price of 6.50 cents a pound for lead.

The official London maximum price of £25 per long ton, duty paid, for Empire and foreign lead, fixed by the British Ministry of Supply in December 1939 was advanced to £30 on June 11, 1945. Quotations of the London Metal Exchange, discontinued at the outbreak of the war in September 1939, were not resumed during 1945.

Average monthly and yearly quoted prices of lead at St. Louis, New York, and London, 1943–45, in cents per pound [1]

	1943			1944			1945		
	St. Louis	New York	London [2]	St. Louis	New York	London [2]	St. Louis	New York	London [2]
January	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.49
February	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.49
March	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.49
April	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.49
May	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.49
June	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.13
July	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
August	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
September	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
October	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
November	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
December	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	5.39
Average	6.35	6.50	4.49	6.35	6.50	4.49	6.35	6.50	4.99

[1] St. Louis: Metal Statistics, 1946, p. 503. New York: Metal Statistics, 1946, p. 495. London: Metal Statistics, 1946, p. 512.
[2] Average price of foreign lead, converted to cents per pound with the pound sterling at \$4.02½. Official maximum price raised on June 11, 1945.

FOREIGN TRADE [2]

Imports.—During 1945 imports of lead dropped to the lowest level since 1940 and were 39 percent below the record total of 1942. As in previous years, the greater part of the lead imported was in the form of pigs and bars, over 70 percent of which came from Mexico and virtually all the remainder from Peru, Canada, and Australia. Receipts of lead in ore and matte, which constituted 23 percent of the total imports, were 25 percent under 1944, due largely to a sharp decrease in imports from Australia and Newfoundland, which more than offset a substantial increase from Peru and Argentina. Imports of lead in ore and matte were principally from Australia, Newfoundland, Peru, Canada, and Argentina, which together supplied 90 percent of these receipts. Imports of lead in base bullion, all from Mexico, dropped to 8 tons. Four countries supplied 91 percent of the total lead in all forms imported in 1945: Mexico 54 percent, Peru 16, Australia 11, and Canada 10, compared with 54, 21, 10, and 3 percent, respectively, for a total of 88 percent in 1944.

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Total lead imported into the United States in ore, matte, base bullion, pigs, bars, and reclaimed, 1941–45, by countries, in short tons [1]

Country	1941	1942	1943	1944	1945
Ore and matte:					
Africa	575	3,879	16,438	3,459	2,338
Argentina	13,374	4,582	----------	----------	4,716
Australia	22,634	20,997	19,743	27,130	17,913
Bolivia	7,314	1,382	7,012	1,093	1,580
Canada	5,725	7,487	6,828	9,909	8,687
Chile	1,384	3,166	----------	4,247	2,330
Mexico	5,770	2,358	2,931	3,693	667
Newfoundland	17,569	23,951	13,473	32,273	17,046
Peru	6,665	11,168	3,426	11,295	14,524
United Kingdom	175	----------	----------	----------	----------
Other countries	930	392	172	471	204
	82,115	79,362	70,023	93,570	70,005
Base bullion:					
Australia	835	42,900	3,846	----------	----------
Mexico	23,726	56	639	11	8
Peru	58	16	94	47	----------
Other countries	85	883	4	----------	----------
	24,704	43,855	4,583	58	8
Pigs and bars:					
Australia	43,631	83,352	8,994	560	13,747
Canada	89,835	69,210	16	8	19,389
Mexico	99,950	192,044	214,865	167,704	160,179
Peru	40,773	21,891	20,158	54,486	34,153
Other countries	----------	----------	----------	----------	1
	274,189	366,497	244,033	222,758	227,469
Reclaimed, scrap, etc.:					
Australia	----------	1,396	----------	2,738	1,470
Canada	52	1,292	348	488	1,374
Panama, Republic of	4	5	128	----------	----------
Peru	95	57	----------	----------	----------
Other countries	55	7	1	89	----------
	206	2,757	477	3,315	2.844
	381,214	492,471	319,116	319,701	300,326

[1] Data include lead imported for immediate consumption plus material entering the country under bond.

Lead [1] *imported for consumption in the United States, 1941–45, by classes*

Year	Lead in ores, flue dust, and mattes, n. s. p. f.		Lead in base bullion		Pigs and bars		Sheets, pipe, and shot		Not otherwise specified (value)	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value		
1941	82,345	$5,343,577	17,579	$1,743,350	325,999	$23,403,260	47	$15,812	$19,389	$30,582,741
1942	87,377	5,715,251	48,589	4,285,425	387,693	32,328,330	20	7,009	4,690	42,478,098
1943	83,153	5,590,218	4,511	557,545	244,033	20,903,382	25	20,208	5,219	27,132,730
1944	100,846	6,756,269	73	7,045	223,379	22,793,430	40	39,572	547	29,895,575
1945	71,046	5,758,695	20	2,242	227,311	25,280,638	14	2,049	32,515	31,311,979

[1] In addition to quantities shown (values included in total values), "reclaimed, scrap, etc.," imported as ollows—1941: 1,331 tons, $57,353; 1942: 1,305 tons, $137,393; 1943: 496 tons, $56,158; 1944: 3,315 tons, $298,712; 1945: 2,844 tons, $235,840. Figures for 1942–45 include foreign lead received by the Government and held in stock piles.

Miscellaneous products, containing lead, imported for consumption in the United States, 1941–45

Year	Babbitt metal, solder, white metal, and other combinations containing lead			Type metal and antimonial lead		
	Gross weight (short tons)	Lead content (short tons)	Value	Gross weight (short tons)	Lead content (short tons)	Value
1941	702	241	$711,388	1,657	1,454	$112,120
1942	971	274	66,096	245	210	19,631
1943	236	69	330,824	3,703	3,422	447,019
1944	26	18	12,706	7,562	7,174	954,255
1945	143	73	101,132	26,085	24,706	3,238,902

Exports.—Total exports of pig lead in 1945 dropped to 9 percent of the 1944 total due almost entirely to the sharp decline in shipments to the U. S. S. R. Export restrictions imposed under the Export Control Act of 1940 remained in force throughout the year.

Lead exported from the United States, 1941–45

Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)	Year	Pigs and bars		Foreign lead exported in manufactures with benefit of draw-back (short tons)
	Short tons	Value			Short tons	Value	
1941	14,359	$1,159,148	21,953	1944	15,523	$2,073,145	20,237
1942	1,940	285,354	26,258	1945	1,407	202,754	(1)
1943	2,003	244,433	15,491				

[1] Data not available.

Pig lead exported from the United States, 1941–45, by destinations, in short tons

Destination	1941	1942 [1]	1943 [1]	1944 [1]	1945 [1]
Countries:					
Brazil	764	51	779	450	406
Chile	822	18	7	23	215
China	2,335			1	
Colombia	196	5	51	34	25
Cuba	97	4	26	18	156
Japan	8,154				
Panama	379	74	8	18	23
Philippine Islands	628				
Portugal	114			542	257
Sweden	112	224			
U. S. S. R.		6	14	14,314	66
United Kingdom		1,379	1,017		
Uruguay	407			7	2
Venezuela	25	20	8	17	75
Other countries	326	159	93	99	182
	14,359	1,940	2,003	15,523	1,407
Continents:					
North America	574	135	80	80	273
South America	2,334	190	883	541	761
Europe	228	1,609	1,031	14,867	323
Asia	11,132	4	6	30	44
Africa and Oceania	91	2	3	5	6

[1] In addition, 3,874 tons of foreign lead were reexported in 1942, 11,258 tons in 1943, less than 1 ton in 1944, and 377 tons in 1945.

717372—47——12

WORLD PRODUCTION

The unconditional surrender of Germany and Japan in May and August 1945, respectively, permitted relaxation of censorship restrictions on production statistics by governments of most of the lead-producing countries in the world. Some information regarding the lead industry in European countries formerly under Axis control has become available during the year, and some progress toward presentation of comprehensive world lead-production statistics during the war years has been made. Nevertheless a statistical hiatus in the record for certain of the important lead-producing centers continues to prevent the final compilation of production data beyond 1940.

World production of lead, 1938–45, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	10,200	13,978	12,864	18,021	20,760	23,800	19,100	21,159
Australia	226,155	269,590	192,186	216,902	210,250	183,528	157,027	160,546
Belgium	94,170	98,230	31,630	8,880	16,240	7,960	7,690	8,470
Burma	80,166	78,622	80,709	74,456	17,130	----	----	----
Canada	181,783	172,880	199,662	206,862	220,722	203,091	129,347	147,451
China	[2] 2,000	(3)	(3)	(3)	[4] 1,315	[4] 1,179	[4] 646	(3)
Czechoslovakia	[2] 5,000	(3)	(3)	(3)	(3)	(3)	(3)	(3)
France	42,183	42,381	25,577	23,220	12,462	13,724	4,572	4,832
Germany [5]	171,700	} 185,700	175,300	172,800	148,900	169,200	[2] 150,000	(3)
Austria	9,280							
Greece	6,050	4,925	(3)	(3)	(3)	(3)	(3)	(3)
Hungary	[2] 150	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Indochina	10	5	(3)	(3)	(3)	(3)	(3)	(3)
Italy	43,287	38,818	36,909	36,993	28,771	(3)	(3)	[2] 800
Japan	16,283	14,223	22,655	25,716	25,832	32,031	34,929	(3)
Korea (Chosen)	6,086	(3)	(3)	(3)	5,184	6,695	11,340	(3)
Mexico	[6] 273,529	213,675	191,980	151,167	192,989	212,452	178,270	[6] 205,316
Northern Rhodesia	277	163	293	378	1,118	1,265	1,047	(3)
Norway	323	321	(3)	(3)	(3)	(3)	(3)	(3)
Peru	28,478	24,310	31,131	32,871	37,915	43,171	38,906	40,001
Poland	19,973	(3)	[3] 23,000	[2] 25,000	(3)	(3)	(3)	[2] 7,000
Rumania	5,655	5,100	(3)	(3)	(3)	(3)	(3)	(3)
South-West Africa	3,214	4,283	690	----	(3)	(3)	(3)	(3)
Spain	31,809	25,991	45,991	46,865	41,149	36,760	30,978	27,133
Sweden	----	----	----	----	230	2,815	7,973	10,433
Tunisia	23,790	22,930	26,620	15,679	(3)	(3)	(3)	(3)
Union of South Africa	19	11	(3)	(3)	(3)	(3)	(3)	(3)
U. S. S. R.	68,490	74,800	[2] 75,000	(3)	[2] 100,000	[2] 125,700	(3)	(3)
United Kingdom	10,000	16,886	13,813	8,097	5,483	4,234	4,033	(3)
United States (refined) [7]	330,963	404,257	468,675	494,126	497,908	425,903	421,538	402,304
Yugoslavia	8,646	10,652	32,949	(3)	(3)	(3)	(3)	(3)
	1,700,000	1,765,000	1,715,000	(3)	(3)	(3)	(3)	(3)

[1] By countries where ~~smelted~~ but not necessarily refined. Data derived in part from Statistical Year-Book of the League of Nations and from the American Bureau of Metal Statistics (annual issue).
[2] Approximate production.
[3] Data not yet available; estimate included in total for 1939 and 1940.
[4] Unoccupied China.
[5] Exclusive of secondary material (Metallgesellschaft, Frankfort on the Main). Beginning in October 1939, includes Upper Silesia.
[6] Includes small tonnage of lead contained in exported ores and concentrates. Separate figures not available.
[7] Figures cover lead refined from domestic and foreign ores; refined lead produced from foreign base bullion not included.

REVIEW BY COUNTRIES

Argentina.—The Aguilar mine of the Compañía Minera Aguilar, S. A., subsidiary of the St. Joseph Lead Co., continued to be the leading producer in 1945, although ore production declined due to shortage of mine timber, fuel oil, and inability of the railroad to provide enough cars for shipping the concentrates from the mine. The lead concentrate production at the Aguilar mine in 1945 was 22,022 metric tons compared with 23,237 tons in 1944.

Australia.—Labor shortages, reportedly the most critical of any year since the beginning of the war, continued to restrict the production of lead at Australian mines and smelters in 1945. At Mount Isa Mines, Ltd., Queensland, a critical manpower shortage permitted operation of the copper section of the mine only. The need for adequate manpower seriously curtailed development programs at the mines.

For the fiscal year ended June 30, 1945, the production of crude ore at the Broken Hill South, Ltd., was 309,605 long tons compared with 341,920 tons output the previous year. A corresponding decrease was reported in the production of lead concentrates.

The Lake George Mining Corp., Ltd., at Captain's Flat, New South Wales, produced 164,549 tons of ore for the fiscal year ended June 30, 1945, compared with 239,900 tons for the previous year, the bulk of the ore for both years being taken from the Keating's ore body. The total estimated ore reserves remaining at the property on June 30 were 1,416,603 tons assaying 1.1 dwt. gold and 1.4 ounces of silver per ton, 7.3 percent lead, 12.8 percent zinc, and 0.7 percent copper.

Bolivia.—Construction of a new lead smelter in southern Bolivia for the purpose of stimulating Bolivia's lead-mining industry and providing exportable refined lead was under consideration early in the year by Banco Minero de Bolivia. The proposed smelter would have a monthly capacity of 300 to 400 tons of refined lead. The location tentatively selected for the smelter is at the junction of the Tupiza and San Juan del Oro Rivers in the Province of Sud Chichas in southern Bolivia.

Brazil.—Construction of a lead smelter (capacity, 20 metric tons of refined lead daily) at the Panelas or Brejauvas mine in Paraná, 20 kilometers from Ribeira, in São Paulo, by Plumbum, S. A., of São Paulo was completed in 1945. It is reported that this company also installed a complete plant for underground development of the mine. The customs smelter at Apiai, São Paulo, remained idle in 1945. The plant, built in 1941 by the State of São Paulo, is reported to have a capacity of 10,000 metric tons of furnace charge a year. Prospecting of lead deposits in the valley of the Ribeira de Iguape was conducted during the year by the States of São Paulo and Paraná.

Burma.—The famous Bawdwin lead-zinc mine and smelter—which before the war produced 75,000 tons of lead a year—was recaptured from the Japanese in February 1945. Engineers of the Burma Corp., owners of the property, reported the lower levels of the mine flooded and the upper levels in critical need of repairs to prevent further deterioration. The concentrating mill and a large section of the residential area were burned by the Japanese. The smelter and appurtenant installations, although suffering from disuse and neglect, were reported in fair condition. Resumption of mining and milling operations is contingent upon reconstruction of portions of the property destroyed during Japanese occupation, replacement of the hydroelectric plant, which was destroyed by the British before evacuation in April 1942, permission of the Shan States to import Indian, Chinese, or Burmese labor, which is at present prohibited or largely restricted, and reconstruction of the destroyed portions of the Burma Railway between Mandalay and Lashio to permit rail transportation of equipment, products, and personnel. The remaining reserves at the property are estimated at approximately 3,500,000 tons of ore averaging 15.7 ounces of silver per ton, 20.4 percent lead, 12.6 percent zinc, and 0.9 percent copper.

Canada.—Lead production increased in Canada in 1945 despite a continued shortage of mine and smelter labor, which showed little improvement until late in the year. At Trail, British Columbia, the Sullivan mine of the Consolidated Mining & Smelting Co., which operates the only Canadian lead smelter and electrolytic lead refinery, continued to be the principal source of Canadian lead production. Refined lead produced at the Trail smelter increased to 163,142 tons from 143,873 tons in 1944. Ore reserves at the end of the year showed a net increase of about 1½ million tons. Nearly 1,400 tons of lead concentrates averaging 80.96 percent lead were recovered during the year from 47,777 tons of ore milled at the Base Metals Mining Corp., Ltd., property in British Columbia. The New Calumet Mines, Ltd., at Calumet Island, Quebec, reported ore reserves on November 1, 1945, at 1,011,200 tons, assaying 2.9 percent lead, 9.1 percent zinc, 5.76 ounces of silver, and 0.038 ounce of gold per ton.

France.—The mine output of lead in France more than doubled in 1945 due largely to the removal of German control of the industry early in the year. Production of lead (content of lead in ores and concentrates) from 1938 through 1945, in metric tons, was as follows:

Year	1938	1939	1940	1941	1942	1943	1944	1945
Production	4,220	5,410	2,440	3,870	5,770	5,471	3,528	7,527

Mines that operated during the year were the La Plagne near Macot, Department of Savoie; Peyrebrune, near Realmont, Department of Tarn; La Loubatiere near Fontiers-Cabardes, Department of Aude; Labarre and Corbieres near Ceilhes, Department of Herault; and Pierrefitte, Department of Hautes-Pyrénées.

Germany.—The chief sources of lead and zinc ores in Germany are Upper Silesia, the Harz Mountains, and along the Rhine River in the Provinces of Rheinland, Westphalia, and Baden. As zinc is predominant in these ores, Germany during the war relied heavily upon imported lead concentrates from Yugoslavia. Newfoundland, Mexico, China, Australia, and Peru were important German prewar sources of lead. The mine production of recoverable lead from German properties from 1938 through 1943, in metric tons, was as follows:

Year	1938	1939	1940	1941	1942	1943
Production	85,026	91,088	91,868	98,693	99,778	104,590

Italy.—Of the three lead smelters in Italy, only one—the Pertusola plant at La Spezia—was damaged sufficiently during the war to prevent immediate resumption of operations.

Mexico.—Mexican mines operated during most of the year without any appreciable difficulties between labor and management, but heavy taxes and poor railroad facilities and service continued to be potent deterrents to operation. Late in the year labor unions presented demands for a 40-percent wage increase; to enforce these demands, a general strike of mine and smelter labor was called on December 31.

Newfoundland.—The mine production, in terms of lead content of concentrates produced, amounted to 22,608 short tons in 1945 compared with 29,661 tons in 1944. The bulk of the concentrates continued to be exported to the United States.

Peru.—The mine production of lead in Peru in 1945 was only slightly under that in the record year 1944. Of the total output, 40,001 tons were refined in bars at the Cerro de Pasco Copper Corp. Oroyo lead smelter and 11,934 tons (lead content) were exported in concentrates.

Spain.—Lead production in Spain declined in 1945 due to power shortages and drought. Jaen Province continued to be the principal producer of lead in 1945, accounting for over half of the total output. The average grade of concentrates in 1945 was 70.6 percent compared with 71.9 percent in 1944. Exports of pig lead declined from 8,142 metric tons in 1944 to 1,163 tons in 1945.

U. S. S. R.—Virtually no official production figures have been available on the Russian lead industry during the last 6 years. Certain data, however, presented in the announcement March 1946 of the new Five Year Plan indicate that lead output has been declining in recent years.

United Kingdom.—Consumption of pig lead (virgin metal) in the United Kingdom totaled 223,591 long tons in 1945 compared with 205,384 tons in 1944. Over-all consumption, including pig lead recovered from scrap, was 294,104 tons (282,621 tons in 1944), of which 26 percent was used in cable covering; 25 percent in sheet and pipe; 17 percent in batteries; 17 percent in white lead and oxides, excluding battery oxide; and 15 percent for miscellaneous purposes

Yugoslavia.—The properties of the Trepca Mines, Ltd., were recovered intact from the Germans in May 1945. Operation of the mine during German occupation is reported to have sharply reduced the ore reserves and damaged much of the plant and equipment. Production on a limited scale was resumed in July 1945, and the output was shipped to Russia.

ZINC [1]

By Richard H. Mote and Esther B. Miller

SUMMARY OUTLINE

GENERAL SUMMARY

Despite operational problems contingent upon reconversion from a wartime to peacetime basis and a persistent shortage of mine and smelter labor, the zinc industry continued to fulfill both civilian and military needs in 1945. Production and imports decreased, but the over-all new supply was sufficient to balance a high level of consumption with ample excess to add to an already high record level of stocks.

Domestic mine output was 15 percent less than in 1944, and total smelter production of primary slab zinc from domestic and foreign ores was 12 percent lower, although at a higher level than in prewar years. Year-end inventories at domestic smelters and consumers' plants were 10 and 14 percent, respectively, more than at the beginning.

Total imports of zinc in ores and concentrates and in the form of slab zinc declined 2 percent from 1944 and 20 percent from the record established in 1943. Ores and concentrates from Mexico and Canada constituted the greater part of the imports in 1945.

The established ceiling price of 8.25 cents a pound for Prime Western zinc at St. Louis remained unchanged throughout 1945.

[1] This report deals primarily with the smelting branch of the industry. Full details of zinc mining are given in the various State reports of this volume. As some zinc ore is used directly in the manufacture of zinc pigments, see chapter on Lead and Zinc Pigments and Zinc Salts.

Salient statistics of the zinc industry in the United States, 1925–29 (average) and 1941–45

	1925–29 (average)	1941	1942	1943	1944	1945
Production of primary slab zinc:						
By sources:						
From domestic ores ... short tons	589,648	652,599	629,957	594,250	574,453	467,084
From foreign ores ... do	12,734	169,421	261,915	348,059	294,849	297,477
	602,382	822,020	891,872	942,309	869,302	764,561
By methods:						
Electrolytic ... percent of total	21	27	28	35	37	35
Distilled ... do	79	73	72	65	63	65
Production of redistilled secondary slab zinc short tons	43,756	59,503	53,195	48,215	49,037	49,242
Stocks on hand at primary smelters Dec. 31 short tons	45,575	24,212	82,498	168,777	233,044	254,765
Primary zinc available for consumption short tons	548,472	762,265	730,938	[1] 806,265	845,008	826,627
Price:						
Prime Western at St. Louis:						
Average for year ... cents per pound	6.76	7.48	8.25	8.25	8.25	8.25
Highest quotation ... do	8.90	8.25	8.25	8.25	8.25	8.25
Lowest quotation ... do	5.40	7.25	8.25	8.25	8.25	8.25
Yearly average at London ... do	6.46	4.63	4.63	4.63	4.63	5.18
Mine production of recoverable zinc short tons	724,720	749,125	768,025	744,196	718,642	614,358
Tri-State district (Joplin) ... percent of total	49	35	31	27	26	23
Western States ... do	30	38	40	43	46	48
Other ... do	21	27	29	30	28	29
World smelter production of zinc ... short tons	1,435,000	(2)	(2)	(2)	(2)	(2)

[1] Revised figure. [2] Data not available.

GOVERNMENT REGULATIONS

During 1945 all Federal Government controls on zinc were eliminated. War Production Board (succeeded by Civilian Production Administration, November 3) Conservation Order M–11–b, which established restrictions and prohibitions on the use of zinc and zinc products, was revoked on June 14. WPB Limitation Order M–353 was revoked on March 26, when miscellaneous chemicals, including zinc sulfide, were made subject to WPB General Preference Order M–340. WPB General Preference Order M–11–1, relating to deliveries of zinc dust, was canceled on May 26; M–11, relating to deliveries of slab zinc, and M–11–a, outlining zinc oxide allocations and restrictions, were canceled on August 20. Import controls on slab zinc were removed on September 5, and Order M–340 was revoked on September 30.

Subsidy payments under the Premium Price Plan for overquota production were continued throughout 1945. A brief outline of the Premium Price Plan and an accompanying table giving production and payments from 1942 through 1945 are given in this chapter under Prices.

Some progress was made during the latter part of the year in providing legislation to authorize the establishment of a Federal Government stock pile of strategic minerals and metals for national defense when the Senate passed the Thomas-May Bill (S. 752) on December 20. Bill S. 752 authorizes the President to appoint a chairman of the Stock-Piling Board, determine what materials are strategic, and establish quantities and dates for stock piling. The Bill further provides that purchases for stock piling shall be made from supplies in excess of current industrial demand and at a price not to exceed the current open market price. Disposition of stock-piled material, unless obsolete for war purposes, cannot be made without 6 months' public notice and Congressional approval. During 1945 a small quantity of slab zinc was purchased for the Government stock pile of strategic metals.

RECIPROCAL TRADE AGREEMENTS

On June 19, 1945, the Senate passed a bill (H. R. 2652) extending the Reciprocal Trade Agreements Act for 3 years and permitting as much as a 50-percent reduction in the rates of duty prevailing on

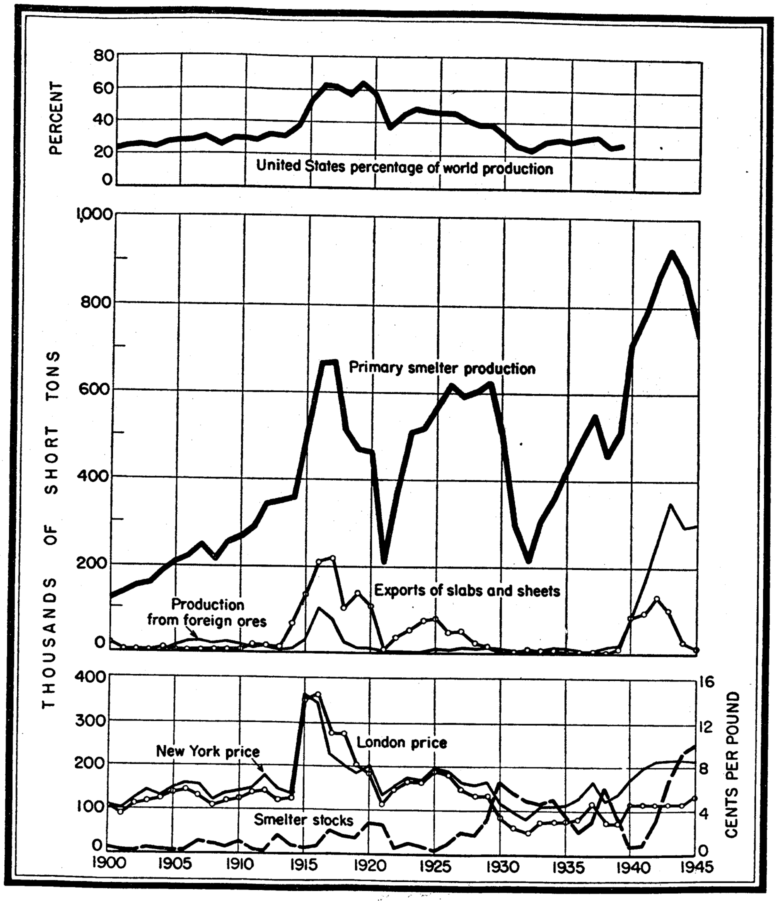

FIGURE 1.—Trends in the zinc industry in the United States, 1900–1945. Imports for consumption of slab and sheet zinc are not shown. Before 1936 they seldom exceeded 500 tons annually, but in recent years they have increased, amounting to 40,559 tons in 1941, 36,402 tons in 1942, 56,155 tons in 1943, 63,641 tons in 1944, and 96,712 tons in 1945.

January 1, 1945. The bill further provided that any temporary reduction under wartime agreements shall remain temporary, however, and any cut in the duty shall be with respect to the rates established by the 1930 Tariff Act. Under the "most-favored-nation" policy.

any reduction embodied in a reciprocal agreement would apply equally to virtually all countries.

The tariff on zinc-bearing ores remained at 1⅕ cents per pound (zinc content), Canada, and ¾ cent, Mexico; and zinc in blocks, pigs or slabs, and dust, 1⅗ cents per pound, Canada, and ⅞ cent, Mexico, during 1945. A provision of the Mexican Trade Agreement of January 30, 1943, provides that the tariff on zinc-bearing ores, blocks, pigs or slabs, and dust would revert to the levels contained in the Canadian Trade Agreement of 1939 (1⅕ cents and 1⅗ cents per pound, respectively) 30 days after the war emergency is announced as being officially terminated.

Figure 1 shows trends in the zinc industry in the United States since 1900.

DOMESTIC PRODUCTION

Zinc-production statistics may be prepared on a mine or on a smelter basis. The mine-production data compiled on a basis of zinc content in ores and concentrates and adjusted to account for average losses in smelting are the most accurate measure of output from year to year. The slab-zinc production, as reported by smelters, presents a more precise figure of actual zinc recovery but generally differs from the mine figure owing to overlap or lag between mine shipments and smelter receipts of ores and concentrates. These variations, however, tend to balance within the limits of statistical error over a period of years.

MINE PRODUCTION

The mine production of recoverable zinc (including that recovered as zinc pigments and salts directly from ore) in the United States decreased 15 percent in 1945 to the lowest level of any year since 1939. The continued drop in output from the wartime peak in 1942 was essentially due to manpower shortages, reportedly the most severe in 1945 of any year during the war period. Zinc mining is centered largely in five areas—the Tri-State area of southeastern Kansas, southwestern Missouri, and northeastern Oklahoma; Tennessee-Virginia; Sussex County, N. J.; St. Lawrence County, N. Y.; and the Western States (principally Idaho, New Mexico, Arizona, Colorado, Utah, Nevada, and Montana, in descending order of productivity in 1945).

Oklahoma, the leading zinc-producing State since 1918 (except for 1931 and 1932 when New Jersey ranked first), dropped to third place in 1945, yielding the lead to Idaho and second place to New Jersey.

The Western States contributed 48 percent of the total domestic output of zinc (46 percent in 1944) despite a 10-percent decline in production. Idaho continued to be the largest producer among the Western States, and, for the first time, ranked first among the States in the United States. More than 93 percent of the Idaho zinc output in 1945 came from the Coeur d'Alene region; zinc-lead ores and old tailings concentrated yielded 88 percent of the total zinc. New Mexico continued to rank second among the Western States despite a 21-percent decline in output. Approximately 90 percent of all zinc produced in New Mexico in 1945 came from the Central district, Grant County; zinc-lead ore yielded 62 percent and zinc ore 38 percent of the total zinc. Arizona took third place over Colorado by a substantial margin as zinc production increased 38 percent over the record output of 1944. About 45 percent of the total zinc came from mines at Bisbee, Cochise County; zinc-lead ore accounted for 85 percent of the total production. Colorado zinc output decreased 10 percent in 1945. Over 44 percent of the Colorado total output came from the Red Cliff district; zinc, zinc-lead, and zinc-lead-copper ores yielded 93 percent of the total zinc produced. Utah output, the lowest since 1935, declined 14 percent in 1945, as all principal zinc-producing districts reported decreased production; about 79 percent of the total zinc was recovered from zinc-lead ores concentrated. Production of zinc in Nevada in 1945 was the greatest in the history of the State. About 77 percent of the total zinc produced was mined in the Pioche district, Lincoln County; nearly 60 percent of the zinc recovered was from zinc-lead ore and 22 percent from lead ore. The output of zinc in Montana declined 52 percent in 1945 due principally to a marked decrease in zinc output from the zinc slag-fuming plant at East Helena; about 62 percent of the total zinc was derived from zinc-lead ore and 32 percent from zinc ore and slag.

Zinc production in the Central States, smallest since 1934, decreased 27 percent from the 1944 output. The Tri-State (Joplin) region maintained its position as the principal zinc-producing district, with 23 percent (26 percent in 1944) of the total United States output.

Mine production of recoverable zinc in the United States, 1925–29 (average) and 1941–45, by States, in short tons

State	1925–29 (average)	1941	1942	1943	1944	1945
Western States:						
Arizona	2,628	16,493	18,522	19,677	29,077	40,226
California	3,999	440	613	1,856	8,455	9,923
Colorado	32,868	15,722	32,215	44,094	39,955	35,773
Idaho	29,128	79,084	87,256	86,707	91,372	83,463
Montana	72,519	60,710	54,715	37,606	36,127	17,403
Nevada	5,570	15,129	10,197	13,647	20,699	21,457
New Mexico	23,351	37,862	46,461	59,524	50,727	40,295
Oregon						1
South Dakota	----	----	115	46	56	----
Utah	44,385	42,049	45,543	46,896	38,994	33,630
Washington	575	14,320	14,398	12,203	11,904	11,693
	215,023	281,809	310,035	322,256	327,366	293,864
Central States:						
Arkansas	71	206	181	96	19	303
Illinois	1,174	9,198	9,389	5,851	7,262	8,310
Kansas	114,323	71,403	55,874	56,944	63,703	48,394
Kentucky	644	427	407	931	341	182
Missouri	16,708	21,932	36,394	30,413	36,626	22,175
Oklahoma	226,969	166,602	146,510	114,085	91,449	69,300
Wisconsin	23,055	6,238	9,426	14,387	15,549	15,561
	382,944	276,006	258,181	222,707	214,949	164,225
Eastern States:						
New Jersey	93,839	93,781	94,040	92,864	80,288	81,392
New York	7,091	38,446	45,807	46,000	35,541	24,978
Tennessee	14,631	36,170	43,971	41,766	40,831	33,824
Virginia	11,192	22,913	15,991	18,603	19,667	16,075
	126,753	191,310	199,809	199,233	176,327	156,269
	724,720	749,125	768,025	744,196	718,642	614,358

Despite a decline of 11 percent in zinc production due largely to a sharp drop in the output from New York, the Eastern States contributed 25 percent of the total domestic output.

Detailed information on the production of mines and districts in the United States may be found in the chapters of this volume dealing with the mine production of gold, silver, copper, lead, and zinc in the various States.

Mine production of recoverable zinc in the United States, by districts that produced 1,000 tons or more during any year, 1941-45, in short tons

District	State	1941	1942	1943	1944	1945
Tri-State (Joplin region)	Kansas, southwestern Missouri, Oklahoma.	258,837	237,936	200,514	190,270	139,274
New Jersey	New Jersey	93,781	94,040	92,864	80,288	81,392
Coeur d'Alene region	Idaho	68,321	78,313	79,634	85,227	78,030
Central	New Mexico	34,649	42,374	52,215	44,648	36,245
Eastern Tennessee	Tennessee	36,170	[1] 43,971	[1] 41,766	[1] 40,831	[1] 33,824
St. Lawrence County	New York	38,446	45,807	46,000	35,541	24,978
Upper Mississippi Valley	Iowa, northern Illinois, Wisconsin.	7,956	11,126	15,539	17,242	19,318
Warren (Bisbee)	Arizona	2,095	1,449	1,020	8,070	18,078
Pioche	Nevada	14,391	8,957	11,991	17,983	16,575
Austinville	Virginia	[1] 22,913	15,793	17,139	18,257	16,000
Red Cliff	Colorado	10,880	22,880	28,854	20,492	15,805
West Mountain (Bingham)	Utah	20,496	22,634	23,405	19,151	14,670
Summit Valley (Butte)	Montana	38,070	29,313	7,877	7,874	8,364
Metaline	Washington	14,201	13,620	9,292	9,236	7,794
Park City region	Utah	16,177	13,026	11,487	9,556	7,435
California (Leadville)	Colorado	48	3,344	5,512	7,984	7,419
Smelter (Tooele County)	Utah	(2)	(2)	(2)	(2)	(2)
Big Bug	Arizona	1,804	2,650	3,009	3,794	4,922
Old Hat (Oracle)	do	-------	579	2,450	2,521	4,750
Kentucky-Southern Illinois	Kentucky, southern Illinois	7,907	8,096	5,630	5,910	4,735
Pioneer (Rico)	Colorado	3,008	2,764	3,652	4,557	3,920
Pima	Arizona	-------	-------	1,390	5,170	3,697
Hunter Valley	California	-------	-------	-------	3,346	3,311
Magdalena	New Mexico	2,580	3,185	5,290	4,474	3,044
Tintic	Utah	797	1,708	2,330	3,450	2,928
Warm Springs	Idaho	8,534	6,260	4,740	4,000	2,797
Chelan Lake	Washington	-------	-------	1,930	1,074	2,419
Pioneer (Superior)	Arizona	4,139	3,884	4,072	3,850	2,297
Smelter (Lewis and Clark County).	Montana	18,751	20,190	24,165	20,623	2,235
Ten Mile	Colorado	70	643	971	1,483	2,142
Campo Seco	California	-------	-------	-------	712	2,134
Heddleston	Montana	548	1,266	953	1,529	1,878
Rush Valley	Utah	(2)	(2)	(2)	(2)	(2)
Flat Creek	California	-------	-------	229	1,532	1,714
Harshaw	Arizona	3,531	4,825	3,398	2,051	1,666
Upper San Miguel	Colorado	-------	390	1,213	828	1,458
Northport	Washington	103	685	914	1,438	1,410
Cochise	Arizona	-------	284	-------	46	1,300
Yankee Hill	California	-------	-------	407	1,444	1,251
Eureka	Nevada	4	-------	40	195	1,204
Sheridan	Montana	187	139	519	1,053	861
Montana	do	1,474	489	203	755	839
Wallapai	Arizona	2,346	2,244	1,542	1,046	684
Patagonia	do	1,788	1,913	1,931	1,261	683
South Mountain	Idaho	2,201	1,485	633	696	678
Packer Creek	Montana	-------	-------	1,001	1,389	254
Eagle	do	1,048	348	256	92	104
Livingston	Virginia	-------	198	1,456	1,410	75

[1] Includes very small quantity produced elsewhere in State.
[2] Bureau of Mines not at liberty to publish.

SMELTER PRODUCTION

ZINC-REDUCTION PLANTS

There was no change during 1945 in the number of active primary zinc-reduction plants. For the last 4 years there have been 22 commercial plants in operation, of which 13 operated with horizontal retorts exclusively, 1 with both horizontal and vertical retorts, 3 with vertical retorts exclusively (one electrothermic), and 5 with electrolytic methods.

The St. Joseph Lead Co. continued experimental operation of its slag-fuming plant at Herculaneum, Mo., in 1945 for the recovery of slab zinc as a direct product of the operation which treats lead blast-furnace slag containing 12 to 16 percent zinc.

Horizontal-retort plants.—The total number of retorts reported at horizontal-retort primary plants in 1945 was 74,120, an increase of 3 percent over the 71,912 retorts at these plants on December 31, 1944. Of the total retorts reported, 54,932 (74 percent) were in use at the close of 1945, an increase of 6 percent over the 52,000 (72 percent) in operation at the end of 1944. The increase can be attributed to a slight increase in the supply of available labor during the latter part of the year.

Vertical-retort plants.—Four vertical-retort continuous distilling plants operated during 1945. The St. Joseph Lead Co. operated its 9 electrothermic units at Josephtown, Pa., at near capacity throughout the year. Of the 66 vertical retorts at the remaining 3 plants, 61 were in operation on December 31, 1945.

Electrolytic plants.—Five electrolytic plants were in operation during 1945, as in 1944. There were 3,210 cells at the plants on December 31, 1945, of which 3,184 (99 percent) were in operation compared with 2,994 (93 percent) at the end of 1944. No new installations were reported under construction or planned.

Smelting capacity.—Irrespective of additions or subtractions of smelter recovery units, statistics on the domestic smelting capacity vary from year to year due to changes in metallurgical practices among the various plants. According to reports to the Bureau of Mines, the zinc-reduction plants in the United States on December 31, 1945, had a stated annual capacity to produce 1,054,000 tons of slab zinc under normal operating conditions, allowing for necessary shut-downs for repairs. This figure, which is 2 percent over the reported capacity at the end of 1944, indicates that the 1945 output was 77 percent of the capacity as compared with 89 percent in 1944. Horizontal- and vertical-retort plants operated at 77 percent of a stated 672,000-ton capacity (86 percent of a 670,000-ton capacity in 1944), electrolytic plants at 80 percent of a 338,000-ton capacity (94 percent in 1944), and secondary smelters at 64 percent of a 44,000-ton capacity (57 percent of a 43,000-ton capacity in 1944).

No additional smelting capacity was planned at the end of 1945, and only a small increase of four graphite retorts was under construction at one smelter.

Waelz kilns.—Waelz plants have been installed in recent years at several midwestern and eastern smelters to facilitate recovery of additional metals from the ore and to reduce over-all smelting losses. The following companies operated Waelz kilns in 1945:

Arkansas:
- Fort Smith—The Residue Co.

Illinois:
- Fairmont City—American Zinc Co. of Illinois.
- Danville—The Hegeler Zinc Co.
- La Salle—Matthiessen & Hegeler Zinc Co.

Kansas:
- Cherryvale—National Zinc Co., Inc.

Oklahoma:
- Henryetta—Eagle-Picher Mining & Smelting Co.

Pennsylvania:
- Donora—American Steel & Wire Co.
- Langeloth—American Zinc & Chemical Co.
- Palmerton—New Jersey Zinc Co.

Active zinc-reduction plants.—A list of the zinc-reduction plants operating in the United States in 1945 follows:

HORIZONTAL-RETORT PLANTS

Arkansas:
- Fort Smith—Athletic Mining & Smelting Co.
- Van Buren—Arkansas Smelting Co.

Illinois:
- Fairmont City—American Zinc Co. of Illinois.
- Danville—The Hegeler Zinc Co.
- La Salle—Matthiessen & Hegeler Zinc Co.

Oklahoma:
- Blackwell—Blackwell Zinc Co.
- Henryetta—Eagle-Picher Mining & Smelting Co.
- Bartlesville—National Zinc Co., Inc.

Pennsylvania:
- Langeloth—American Zinc & Chemical Co.
- Donora—American Steel & Wire Co.
- Palmerton—The New Jersey Zinc Co. of Penna.

Texas:
- Amarillo—American Smelting & Refining Co.
- Dumas—American Zinc Co. of Illinois.

West Virginia:
- Moundsville—United Zinc Smelting Corp.[2]

VERTICAL-RETORT PLANTS

Illinois:
- Depue—The New Jersey Zinc Co.

Pennsylvania:
- Palmerton—The New Jersey Zinc Co. of Penna.
- Josephtown—St. Joseph Lead Co.

West Virginia:
- Meadowbrook—E. I. du Pont de Nemours & Co.

ELECTROLYTIC PLANTS

Idaho:
- Kellogg—Sullivan Mining Co.

Illinois:
- East St. Louis—American Zinc Co. of Illinois.

Montana:
- Anaconda—Anaconda Copper Mining Co.
- Great Falls—Anaconda Copper Mining Co.

Texas:
- Corpus Christi—American Smelting & Refining Co.

PRODUCTION OF PRIMARY AND REDISTILLED SECONDARY SLAB ZINC

The output of primary slab zinc in 1945, the smallest since 1940, dropped 12 percent below the 1944 production. The use of foreign ore continued at a high level and the slab zinc produced from this source gained slightly in 1945. Production from domestic ore, lowest since 1938, declined 19 percent to continue the downward trend in evidence since 1941.

[2] Operations suspended July 10, 1945.

Production of redistilled slab zinc from zinc scrap remained virtually the same in 1945. Of the 49,242 short tons of redistilled secondary slab zinc produced, 21,205 tons (43 percent) were derived from primary smelters, and 28,037 tons (57 percent) were produced at secondary plants. Data on the output of remelted secondary slab zinc are not included with those for redistilled metal. In 1945 the production of slab zinc recovered by remelting purchased scrap amounted to 8,090 tons (7,741 tons in 1944). Zinc rolling mills and other consumers of slab zinc recover large quantities of zinc from their own plant scrap; but such metal is not measured statistically, for it normally does not enter the market as scrap.

Primary and redistilled secondary slab zinc produced in the United States, 1941–45, in short tons

Year	Primary			Redistilled secondary	Total (excludes zinc recovered by remelting)
	Domestic	Foreign [1]	Total		
1941	652,599	169,421	822,020	59,503	881,523
1942	629,957	[2] 261,915	891,872	53,195	945,067
1943	594,250	[2] 348,059	942,309	48,215	990,524
1944	574,453	[2] 294,849	869,302	49,037	918,339
1945	467,084	[2] 297,477	764,561	49,242	813,803

[1] Most of the foreign ores smelted in the United States in 1941 originated in Mexico, Canada, Newfoundland, and Peru; in 1942, in Mexico, Canada, Argentina, Newfoundland, Australia, and Peru; in 1943, in Canada, Mexico, and Australia; in 1944, in Mexico, Canada, Australia, Newfoundland, and Argentina; in 1945, in Mexico, Canada, Australia, Peru, Newfoundland, Argentina, and Bolivia.

[2] Includes a small tonnage of foreign slab zinc further refined into high-grade metal in the United States.

DISTILLED AND ELECTROLYTIC ZINC

Of the 1945 output of primary zinc, 65 percent was distilled and 35 percent was produced electrolytically compared with 63 and 37 percent, respectively, in 1944.

A continued decline in the demand for brass products for ammunition due to sharp reductions in military requirements was largely the cause for a decrease in the output of the higher grades of slab zinc. The available capacity for redistilling Selected and Prime Western zinc into High-Grade zinc was not fully utilized during the year. The output of electrolytic zinc plants, important producers of High-Grade zinc, dropped 15 percent as compared with a 10-percent decline in production of distilled primary zinc.

Brass Special was the only grade of slab zinc of which production increased in 1945, the total output being 39 percent above the 1944 figure. In contrast, Special High Grade decreased 12 percent, Regular (Ordinary) High Grade 24 percent, Intermediate 12 percent, Selected 29 percent, and Prime Western 8 percent. The original first-stage smelter production of the two lower grades of zinc was somewhat higher than is indicated in the following table, but to avoid duplication the quantity of each grade consumed in redistilling was omitted because the resultant Special and Regular High Grade slab zinc thus produced is reported. Of the total 1945 production (comparable 1944 figures in parentheses), 32 percent (31 percent) was Prime Western, 27 percent (27 percent) Special High Grade, 24 percent (27 percent) Regular High Grade, 9 percent (6 percent) Brass

Special, 6 percent (6 percent) Intermediate, and 2 percent (3 percent) Selected.

Distilled and electrolytic zinc, primary and secondary, produced in the United States, 1941–45, in short tons

CLASSIFIED ACCORDING TO METHOD OF REDUCTION

Year	Electrolytic primary	Distilled	Redistilled secondary [1]		Total
			At primary smelters	At secondary smelters	
1941	224,313	597,707	27,904	31,599	881,523
1942	252,987	638,885	20,978	32,217	945,067
1943	329,902	612,407	24,385	23,830	990,524
1944	317,388	551,914	24,673	24,364	918,339
1945	269,924	494,637	21,205	28,037	813,803

CLASSIFIED ACCORDING TO GRADE

Year	Grade A		Grade B (Intermediate)	Grades C and D		Grade E (Prime Western)	Total
	Special High Grade (99.99% Zn)	Regular High Grade (Ordinary)		Brass Special	Selected		
1941	203,030	177,451	74,797	73,968	5,152	347,125	881,523
1942	231,422	250,501	77,527	86,176	26,800	272,641	945,067
1943	293,168	303,743	62,700	82,072	20,445	228,396	990,524
1944	251,210	251,595	55,928	54,396	24,396	280,814	918,339
1945	220,241	191,639	49,106	75,749	17,367	259,701	813,803

[1] For total production of secondary zinc see chapter on Secondary Metals—Nonferrous.

PRODUCTION OF PRIMARY SLAB ZINC BY STATES

Pennsylvania was the leading producer of slab zinc in 1945, thus regaining the rank held every year but two since 1943. Montana, which displaced Pennsylvania in 1943 and 1944, dropped to second place and was followed by Illinois. Of the States for which production data may be released, Oklahoma, Idaho, and Arkansas occupied the next three positions, in order of decreasing importance. Each State showed a decline in output from 1944. Montana and Idaho, as usual, produced electrolytic zinc only, Illinois and Texas made both electrolytic and distilled metal, and all other States confined their operations to distillation alone. Experimental production of slab zinc directly from the treatment of lead-smelter slag by the fuming process continued for the third year at a Missouri plant.

Some indication of the movement of foreign ores and concentrates within the United States is revealed when a breakdown of the production of primary slab zinc from this source is considered. Of the 297,477 tons of primary slab zinc of foreign origin recovered in 1945, smelters in Pennsylvania accounted for 26 percent, Montana 23 percent, Oklahoma 20 percent, Illinois 17 percent, and Texas, West Virginia, and Arkansas combined 14 percent. Only two smelters, one in Illinois and one in West Virginia, operated exclusively on domestic ores and concentrates. Of the total slab zinc produced from foreign ores and concentrates, 38 percent was recovered by electrolytic methods and 62 percent by distillation.

Primary slab zinc produced in the United States, by States where smelted, 1941–45, in short tons

Year	Arkansas	Idaho	Illinois	Montana	Oklahoma	Pennsylvania	Other States [1]	Total	
								Short tons	Value
1941	44, 045	39, 285	121, 921	176, 406	105, 885	222, 486	111, 992	822, 020	$123, 303, 000
1942	41, 649	39, 916	175, 455	193, 486	102, 422	231, 362	107, 582	891, 872	155, 186, 000
1943	35, 704	41, 129	221, 680	237, 585	72, 043	218, 058	116, 110	942, 309	162, 076, 000
1944	31, 350	36, 562	155, 362	224, 391	[2] 107, 364	[2] 206, 315	[2] 107, 958	[2] 869, 302	[2] 149, 520, 000
1945	29, 391	33, 110	124, 904	179, 251	106, 115	200, 709	91, 081	764, 561	131, 504, 492

[1] Texas and West Virginia; also Missouri in 1943 and 1944.
[2] Revised figure.

SECONDARY ZINC

In addition to the redistilled secondary slab zinc (unalloyed) already reported herein, some remelted slab zinc is produced, and a large quantity of secondary zinc is recovered each year in the form of alloys, zinc dust, zinc pigments, and zinc salts. Additional information on secondary zinc is given in this volume in the chapter on Secondary Metals—Nonferrous.

BYPRODUCT SULFURIC ACID

Sulfuric acid made from the sulfur dioxide gases produced in roasting zinc blende (sphalerite) is an important byproduct of zinc smelting. To utilize a larger proportion of their acid-producing capacity, some plants also consume large quantities of sulfur. The production of sulfuric acid at zinc-blende roasting plants decreased 6 percent in 1945.

Sulfuric acid (60° B. basis) made at zinc-blende roasting plants in the United States, 1941–45

Year	Made rom zinc blende [1]		Made from sulfur		Total [1]		
						Value [2]	
	Short tons	Value [2]	Short tons	Value [2]	Short tons	Total	Average per ton
1941	672, 177	$5, 706, 783	148, 257	$1, 258, 702	820, 434	$6, 965, 485	$8. 49
1942	695, 242	6, 570, 037	147, 513	1, 393, 998	842, 755	7, 964, 035	9. 45
1943	[3] 879, 266	[3] 8, 687, 148	155, 210	[3] 1, 533, 475	[3] 1, 034, 476	[3] 10, 220, 623	[3] 9. 88
1944	[3] 839, 451	[3] 8, 344, 143	[3] 258, 927	[3] 2, 573, 734	[3] 1, 098, 378	[3] 10, 917, 877	9. 94
1945	786, 582	7, 944, 478	303, 327	3, 063, 603	1, 089, 909	11, 008, 081	10. 10

[1] Includes acid from foreign blende.
[2] At average of sales of 60° acid.
[3] Revised figures.

ZINC DUST

Zinc-dust production declined 2 percent from the peak output in 1944. Zinc powder and blue powder are not included in the total produced; the zinc dust statistically reported is restricted to commercial grades that comply with severe specifications as to percentage of unoxidized metal, evenness of grading, and fineness of the particles. The zinc content of the dust produced in 1945 ranged from 94.20 to

99.73 percent and averaged 97.46 percent. Shipments of zinc dust totaled 25,151 tons, of which 350 tons or 1 percent went to foreign countries. This figure is possibly somewhat low, as Federal Government purchases (of which a part was eventually shipped abroad) were not given separately, and a portion of this quantity doubtless was reported as domestic shipments. Shipments of zinc dust were slightly lower than production, and as the quantity consumed at manufacturers' plants was small (1 percent of output), producers' stocks showed a moderate increase from 1,285 tons (corrected figure) at the beginning to 1,750 tons at the close of the year.

The average price of zinc dust shipped to domestic consumers in 1945 was 10.1 cents a pound, as in 1944. The raw materials used to manufacture zinc dust are reviewed in this volume in the chapter on Secondary Metals—Nonferrous. Most of the production is from zinc scrap, principally galvanizers' dross, but some is recovered from zinc ore, slab zinc, and as a byproduct of zinc refining.

Zinc dust [1] produced in the United States, 1941–45

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per pound			Total	Average per pound
1941	24,429	$4,641,580	$0.095	1944	26,511	$5,408,244	$0.102
1942	22,805	4,789,050	.105	1945	25,877	5,227,154	.101
1943	25,990	5,249,980	.101				

[1] All produced by distillation.

ZINC PIGMENTS AND SALTS

The principal zinc pigments are zinc oxide and lithopone, and the principal salts are the chloride and sulfate. These products are manufactured from various zinc-bearing materials, including ore, metal, scrap, and residues. Details of the production of zinc pigments and salts are given in this volume in the chapter on Lead and Zinc Pigments and Zinc Salts.

STOCKS

PRODUCERS' STOCKS

Inventories of slab zinc at producers' plants continued to increase in 1945 and by December 31 were 10 percent above the previous year-end record total. Of the 256,216 tons on hand at the end of the year, 169,679 tons were Special High Grade and Regular High Grade and the remainder (86,537 tons) of lower grades, compared with 159,489 tons and 74,207 tons, respectively, at the end of 1944. Nearly the entire gain can be accounted for by the accumulation of Brass Special and High-Grade Zinc.

According to the American Zinc Institute, stocks of slab zinc followed a general downward trend until the end of April but advanced without interruption during the remaining months of the year.

Stocks of zinc ore (60-percent concentrates) in the Tri-State district (as reported by the Tri-State Zinc and Lead Ore Producers' Association) were 4,664 tons at the beginning of 1945. High point of the year was reached on January 27, with a total of 4,684 tons. For the remainder of 1945, stocks showed a slight trend downward to a low of 2,690 tons on July 7, followed by a general increase to 4,378 tons on December 22 and closing on December 29 at 3,677 tons. The noticeable lack of sharp variations in stocks of zinc concentrates reflects the financial assistance to smelters treating Tri-State concentrates, which assistance was in the form of special premium payments from the Office of Metals Reserve and permitted the smelters to accept and treat profitably virtually all concentrates offered.

Stocks of zinc on hand at zinc-reduction plants in the United States at end of year, 1941–45, in short tons

	1941	1942	1943	1944	1945
At primary reduction plants	24,212	82,498	168,777	233,044	254,765
At secondary distilling plants	890	1,942	1,829	652	1,451
	25,102	84,440	170,606	233,696	256,216

According to an American Zinc Institute survey, total stocks of domestic and foreign zinc ore and concentrates at primary zinc-reduction plants on December 31, 1945, totaled 911,624 tons averaging 55 percent zinc. This compares with 734,506 tons containing 54 percent zinc at the end of 1944.

CONSUMERS' STOCKS

Stocks of slab zinc at consumers' plants increased moderately in 1945, the total on December 31 being 14 percent over the quantity on hand at the beginning of the year. Inventories increased abruptly from the low point at the first of the year to a high of about 103,350 tons on April 30, followed by a general downward trend during the remainder of the year. A 24-percent drop in slab-zinc inventories at brass mills, ingot makers, and foundries reflects the sharp reduction in military requirements for zinc in the manufacture of brass following termination of the war. At the average monthly rate of consumption in 1945, consumers' stocks on hand at the end of 1945 were slightly more than 1 month's requirements. Exclusive of an indeterminate quantity in bonded warehouses, the approximate total slab zinc in stock (including company- and Government-owned stocks at producers' plants) on December 31, 1945, was 351,000 tons compared with 318,000 tons at the end of 1944.

Consumers' stocks of slab zinc at plants at the beginning and end of 1945, by industries, in short tons

	Galvanizers	Die casters [1]	Brass mills [2]	Zinc rolling mills	Oxide plants	Others	Total
Dec. 31, 1944	[3] 27,129	[3] 5,294	[3] 25,052	[3] 4,972	786	[3] 1,539	[3,4] 64,772
Dec. 31, 1945	33,915	11,900	18,951	6,317	612	1,848	[4] 73,543

[1] Includes producers of zinc-base die castings, zinc-alloy dies, and zinc-alloy rods.
[2] Includes brass mills, brass ingot makers, and brass products.
[3] Revised figures.
[4] Stocks on December 31, 1944 and 1945, exclude 482 tons and 428 tons, respectively, of remelt spelter.

DOMESTIC CONSUMPTION

NEW SUPPLY

The following table shows the 5-year record of primary slab zinc available for consumption in the United States. This calculated quantity, in effect, is equivalent to primary slab zinc apparently made available each year for shipment to domestic consumers during the year.

In addition to primary slab zinc, 48,443 tons of redistilled secondary slab zinc were made available to consumers in 1945 after allowance for an increase in stocks at secondary smelters. Also 8,090 tons of remelt spelter were produced from purchased scrap.

Primary slab zinc available for consumption in the United States, 1941–45, in short tons

	1941	1942	1943	1944	1945
Supply:					
Stock at smelters Jan. 1	19, 212	24, 212	82, 498	168, 777	233, 044
Production	822, 020	[1] 886, 810	[1] 933, 828	[1] 867, 225	[1] 764, 316
Imports	34, 554	36, 352	56, 155	63, 626	97, 116
Total available	875, 786	947, 374	1, 072, 481	1, 099, 628	1, 094, 476
Withdrawn:					
Exports	89, 309	133, 938	97, 439	21, 576	7, 782
Shipments for Government account					5, 302
Stock at smelters Dec. 31	24, 212	82, 498	[2] 168, 777	233, 044	254, 765
Total withdrawn	113, 521	216, 436	[2] 266, 216	254, 620	267, 849
Available for consumption	762, 265	730, 938	[2] 806, 265	845, 008	826, 627

[1] Adjusted to exclude imported slab zinc further refined into high-grade metal in the United States.
[2] Revised figures.

CONSUMPTION

According to reports from 690 plants, representing an estimated 98 percent of the consuming industry in the United States, 852,311 tons of slab zinc (including 5,111 tons of purchased remelt spelter) were put in process in 1945, a 4-percent decline from the record attained in 1944. Receipts at consumers' plants during 1945 were 861,028 tons. The apparent discrepancy between this figure and the calculated 883,160 tons of primary and secondary slab zinc and remelt spelter shipped to domestic consumers in 1945 can be attributed to incomplete coverage of the survey, variations in the quantity of metal in transit from producer to consumer at the beginning and the end of the year, and unaccounted-for slab zinc stored in bonded warehouses.

With the end of hostilities the two major use categories of slab zinc returned to their prewar relationship. Galvanizing regained its position as the principal use of slab zinc; the quantity consumed for this purpose in 1945 gained 7 percent over 1944. The use of slab zinc for brass products, through cut-backs in military orders for cartridge brass, declined 32 percent during the year. The quantity of zinc used for zinc-base alloys was 55 percent greater than in 1944, whereas zinc for French-process oxide declined 10 percent.

Consumption of slab zinc in the United States, 1941–45, by industries, in short tons [1]

Industry and product	1941	1942	1943	1944	1945
Galvanizing: [2]					
Sheet and strip	129,028	76,106	72,233	119,381	135,383
Tubes and pipe	69,749	47,085	51,023	50,472	63,163
Wire and wire rope	41,408	35,216	37,391	44,350	46,083
Wire cloth	11,307	7,320	(3)	(3)	(3)
Fittings	(3)	(3)	14,549	14,113	10,014
Other [4]	99,362	81,764	78,005	87,675	82,538
	350,854	247,491	253,201	315,991	337,181
Brass products:					
Sheet, strip, and plate			287,962	246,402	146,375
Rod and wire	195,714	292,820	66,538	70,970	67,299
Tube			24,456	27,725	21,507
Castings and billets			16,851	16,703	12,942
Copper-base ingots	32,324	27,126	20,384	17,174	9,893
Other copper-base products			2,888	2,953	1,361
	228,038	319,946	419,079	381,927	259,377
Zinc-base alloy:					
Die castings	151,875	58,918	60,115	76,201	121,966
Alloy dies and rod		21,227	16,067	8,245	8,286
Slush and sand castings	(5)	(5)	143	75	584
	151,875	80,145	76,325	84,521	130,836
Rolled zinc	71,795	66,045	48,529	76,524	97,589
Zinc oxide	16,128	7,977	11,496	20,198	18,113
Other uses:					
Slush castings	751	552	(6)	(6)	(6)
Wet batteries	1,767	1,667	1,807	2,174	1,790
Desilverizing lead	1,431	1,251	2,178	2,051	2,095
Light-metal alloys	(3)	(3)	1,074	2,047	1,469
Other [7]	4,796	3,095	3,088	3,193	3,861
	8,745	6,565	8,147	9,465	9,215
Total: All uses	827,435	728,169	816,777	[8] 888,626	[8] 852,311

[1] Based on a canvass of 600 plants in 1941 and 1942 and a somewhat larger coverage in 1943, 1944, and 1945 mostly from small consumers.
[2] Includes zinc used in electrogalvanizing, but excludes sherardizing.
[3] Separate figures not available but included in "Other."
[4] Includes miscellaneous articles not given elsewhere.
[5] Included under "Other uses" in 1941 and 1942.
[6] Included under "Zinc-base alloy" in 1943, 1944, and 1945.
[7] Includes zinc used in making zinc dust, bronze powder, alloys, chemicals, castings, and miscellaneous uses not elsewhere mentioned.
[8] Includes 6,982 tons of remelt zinc in 1944 and 5,111 tons in 1945.

Zinc for rolled products continued to gain in 1945; the quantity used for this purpose was 28 percent greater than in 1944. In addition to slab zinc, the rolling mills remelt and reroll the metallic scrap produced from their fabricating operations. The scrap so treated in 1945 amounted to 31,968 tons—a 48-percent increase from the comparable total processed in 1944. Purchased zinc scrap in the form of zinc clippings, old zinc scrap, and engravers' plates totaling 3,652 tons were melted and rolled in 1945 (1,786 tons in 1944). Production of rolled zinc from slab zinc and purchased scrap was 98,384 tons, an increase of 29 percent over the total for 1944. The total value of rolled products was 30 percent more than in 1944. Inventories of rolled zinc were 1,885 tons on December 31, 1945, compared with 1,700 tons (revised figure) on the same date in 1944. In addition to the actual shipments of 60,153 tons of rolled zinc in 1945, the rolling mills processed 70,014 tons of rolled zinc (including that which was remelted and rerolled) in manufacturing 41,499 tons of semifabricated and finished products.

Rolled zinc produced and quantity available for consumption in the United States, 1944–45

	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average per pound		Total	Average per pound
Production:						
Sheet zinc not over 0.1 inch thick	10,902	$3,154,000	$0.145	16,746	$4,624,274	$0.138
Boiler plate and sheets over 0.1 inch thick	5,998	1,365,000	.114	3,057	717,301	.117
Strip and ribbon zinc [1]	58,230	13,997,000	.120	77,175	18,817,191	.122
Foil, rod, and wire	1,359	504,000	.185	1,406	559,213	.199
Total rolled zinc	76,489	19,020,000	.124	98,384	24,717,979	.126
Imports	15	2,500	.085	(2)		
Exports	3,403	878,700	.129	5,418	1,484,826	.137
Available for consumption	[3] 72,749			[3] 98,109		
Value of slab zinc (all grades)			.086			.086
Value added by rolling			.038			.040

[1] Figures represent net production. In addition, 21,555 tons of strip and ribbon zinc in 1944 and 31,968 tons in 1945 were rerolled from scrap originating in fabricating plants in connection with zinc rolling mills.
[2] Less than 1 ton.
[3] Allowances made for change in producers' stocks of rolled zinc.

The following table shows the six commercial grades of refined slab zinc and purchased remelt spelter consumed by the various industries in 1945. Of the 852,311 tons of domestic and foreign zinc consumed, 38 percent was Prime Western, 25 percent Special High Grade, and 22 percent Regular High Grade, compared with 35, 27, and 24 percent, respectively, in 1944. All grades of zinc were used for galvanizing and in the manufacture of brass and rolled zinc products. Prime Western was the principal grade used in the hot-dip process of galvanizing, the higher grades being used chiefly for electrogalvanizing. Rigid specifications in brass manufacture necessitate the use of high-purity metal, 72 percent of the total used in this industry being of the two highest grades.

Consumption of slab zinc in the United States in 1945, by grades, according to industry, in short tons

	Special High Grade	Regular High Grade	Intermediate	Brass Special	Selected	Prime Western	Remelt	Total
Galvanizing	10,909	8,049	10,505	8,759	1,387	294,234	3,338	337,181
Brass products	65,802	119,999	17,952	21,906	6,013	26,497	1,208	259,377
Zinc-base alloy	128,318	1,960	21	0	0	501	36	130,836
Rolled zinc	3,953	43,636	20,103	26,917	790	2,186	4	97,589
Zinc oxide	2,667	15,001	0	88	0	0	357	18,113
Other uses	1,963	2,767	1,257	600	0	2,460	168	9,215
Total	213,612	191,412	49,838	58,270	8,190	325,878	5,111	852,311

PRICES

The base ceiling price established by the Office of Price Administration of 8.25 cents a pound for Prime Western-grade slab zinc at St. Louis and $55.28 per ton of 60-percent concentrates at Joplin, Mo., remained unchanged throughout 1945. In comparison, the weighted average price received by the producers for all grades of zinc sold in 1945 was 8.6 cents a pound, f. o. b. plants, as in 1944 and in 1943. The 1945 price of 11.5 cents for zinc, which appears in the State chapters, represents the weighted average price received for all grades of slab zinc (8.6 cents) plus the increment—in terms of cents per pound based upon the total mine output of recoverable zinc—of $36,205,177 in subsidies for overquota production and special mine and smelter contracts paid by the Office of Metals Reserve (successor July 1, 1945, to the Metals Reserve Company).

The general policy of the Quota Committee pertaining to the Premium Price Plan for overquota mine production of domestic zinc (copper and lead were also included in the plan) prevailed throughout 1945. The original plan in force since February 1, 1942, was operative only until July 31, 1945. Congress voted the Hayden-McFarland bill, S. 502, into Public Law 88 on June 14, 1945, extending the plan until June 30, 1946. A compilation of important data showing production of zinc under the Premium Price Plan since February 1942 at the various quota levels and the payments made is given in the following table.

Salient statistics on zinc with regard to operation of Premium Price Plan, 1942–45 [1]

	1942 [2]			1943			1944			1945		
	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total	Tri-State district	U. S. exclusive of Tri-State	U. S. total
Total production of recoverable zinc [3]......short tons..	216,367	479,881	696,248	200,103	540,565	740,668	200,341	515,465	715,806	140,181	474,177	614,358
Ceiling production at 8.25 cents a pound........do....	95,050	400,984	496,034	11,930	326,251	338,181	20,911	251,105	272,016	5,672	204,633	210,305
Ceiling production, proportion of total.......percent..	43.93	83.56	71.24	5.96	60.35	45.66	10.44	48.71	38.00	4.05	43.16	34.23
Overceiling production under Premium Price Plan:												
"A" quota only (11.00 cents a pound)..short tons..	120,681	75,617	196,298	92,650	146,639	239,289	65,714	171,328	237,042	41,388	191,328	232,716
"B" quota (13.75 cents a pound)..............do....	573	1,923	2,496	58,243	40,045	98,288	65,779	56,015	121,794	52,135	39,444	91,579
"C" quota (16.50 cents a pound).............do....	63	734	797	34,803	22,778	57,581	42,080	31,421	73,501	35,192	36,009	71,201
Total premium production..................do....	121,317	78,274	199,591	185,696	209,462	395,158	173,573	258,764	432,337	128,715	266,781	395,496
Metals Reserve mine contracts...............do....	....	623	623	2,477	4,852	7,329	5,857	5,596	11,453	5,794	2,763	8,557
Total overceiling production..................do....	121,317	78,897	200,214	188,173	214,314	402,487	179,430	264,360	443,790	134,509	269,544	404,053
Overceiling production, proportion of total:												
Production under Premium Price Plan:												
"A" quota only.........................percent..	55.78	15.76	28.19	46.30	27.13	32.31	32.80	33.24	33.12	29.53	40.35	37.88
"B" quota (also received "A")..........do....	.26	.40	.36	29.11	7.41	13.27	32.83	10.87	17.01	37.19	8.32	14.91
"C" quota (also received "A" and "B").do....	.03	.15	.12	17.39	4.21	7.77	21.01	6.09	10.27	25.10	7.59	11.59
Total premium production............do....	56.07	16.31	28.67	92.80	38.75	53.35	86.64	50.20	60.40	91.82	56.26	64.38
Metals Reserve mine contracts..........do....	....	.13	.09	1.24	.90	.99	2.92	1.09	1.60	4.13	.58	1.39
Total overceiling production.............do....	56.07	16.44	28.76	94.04	39.65	54.34	89.56	51.29	62.00	95.95	56.84	65.77
Payments under Premium Price Plan: [4]												
"A" premium..........................dollars..	6,672,409	4,305,059	10,977,468	10,213,269	11,520,444	21,733,713	9,546,487	14,283,080	23,829,567	7,079,337	14,672,969	21,752,306
"B" premium..............................do....	34,936	146,141	181,077	5,117,544	3,455,281	8,572,825	5,932,208	4,809,086	10,741,294	4,802,986	4,149,882	8,952,868
"C" premium..............................do....	3,446	40,394	43,840	1,914,183	1,252,814	3,166,997	2,314,401	1,728,271	4,042,672	1,935,543	1,980,489	3,916,032
Total premium production..................do....	6,710,791	4,491,594	11,202,385	17,244,996	16,228,539	33,473,535	17,793,096	20,820,437	38,613,533	13,817,866	20,803,340	34,621,206
Metals Reserve payments to smelters [4]........do....	....	....	....	....	....	....	402,580	....	402,580	875,247	....	875,247
Metals Reserve mine contracts [4]...............do....	....	36,501	36,501	225,005	280,353	505,358	578,737	313,792	892,529	550,979	157,745	708,724
Total overceiling payments....................do....	6,710,791	4,528,095	11,238,886	17,470,001	16,508,892	33,978,893	18,774,413	21,134,229	39,908,642	15,244,092	20,961,085	36,205,177
Average prices per pound of zinc: [5]												
Average premium production...............cents..	11.016	11.119	11.056	12.893	12.124	12.485	13.376	12.273	12.716	13.618	12.150	12.627
Metals Reserve mine contracts...............do....	....	11.179	11.179	12.791	11.139	11.698	13.190	11.054	12.146	13.005	11.105	12.391
Total overceiling production..................do....	11.016	11.120	11.057	12.892	12.102	12.471	13.482	12.247	12.746	13.917	12.138	12.730
Total production............................do....	9.801	8.722	9.057	12.615	9.777	10.544	12.936	10.300	11.038	13.687	10.460	11.197

[1] Compiled from a report of the OPA. Data subject to revision. [2] Premium Price Plan effective February 1, 1942; data refer to February–December, inclusive.

[3] Production of Tri-State zinc from Office of Metals Reserve agency, Joplin, Mo.; all other from Bureau of Mines monthly reports. These data are preliminary and do not exactly equal final annual totals for the United States except for 1945.

[4] Data on premium payments, payments to smelters, and Metals Reserve mine-contract payments from Office of Metals Reserve. All payments shown are subject to correction due to additional payments as a result of retroactive quota adjustments, late reports by smelters and custom mills, etc.

[5] All average prices shown include OPA ceiling price of 8.25 cents a pound for zinc.

The official London maximum price of £25 15s. per long ton, duty paid, for foreign zinc delivered to consumers, and £26 10s. for domestic metal, including secondary, fixed by the British Ministry of Supply in December 1939, was advanced to £31 5s. and £32 0s., respectively, on June 11, 1945. Quotations of the London Metal Exchange, discontinued at the outbreak of the war in September 1939, were not resumed during 1945.

Price of zinc and zinc concentrates, 1941–45

	1941	1942	1943	1944	1945
Average price common zinc at—					
St. Louis (spot) .... cents per pound..	7.48	8.25	8.25	8.25	8.25
New York .... do....	7.87	8.66	8.66	8.65	8.65
London [1] .... do....	4.63	4.63	4.63	4.63	5.18
Excess New York over London .... do....	3.24	4.03	4.03	4.02	3.47
Joplin 60-percent zinc concentrates:					
Price per short ton .... dollars..	49.80	55.28	55.28	55.28	55.28
Price of zinc content .... cents per pound..	4.15	4.61	4.61	4.61	4.61
Smelter margin .... do....	3.33	3.64	3.64	3.64	3.64
Price indexes (1925–29 average=100):					
Zinc (New York)	111	122	122	122	122
Lead (New York)	78	87	87	87	87
Copper (New York)	80	80	80	80	80
Nonferrous metals [2]	85	87	87	87	87
All commodities [2]	89	101	105	106	108

[1] Average price for foreign zinc, converted to cents per pound with the pound sterling at \$4.02½.
[2] Based upon price indexes of U. S. Department of Labor.

Average monthly quoted prices of common zinc (prompt delivery or spot) St. Louis and London, and of 60-percent zinc concentrates at Joplin, 1944–45 [1]

Month	1944			1945		
	60-percent zinc concentrates in the Joplin region (dollars per ton) [2]	Metallic zinc (cents per pound)		60-percent zinc concentrates in the Joplin region (dollars per ton) [2]	Metallic zinc (cents per pound)	
		St. Louis	London [3]		St. Louis	London [3]
January	\$55.28	8.25	4.63	\$55.28	8.25	4.63
February	55.28	8.25	4.63	55.28	8.25	4.63
March	55.28	8.25	4.63	55.28	8.25	4.63
April	55.28	8.25	4.63	55.28	8.25	4.63
May	55.28	8.25	4.63	55.28	8.25	4.63
June	55.28	8.25	4.63	55.28	8.25	5.34
July	55.28	8.25	4.63	55.28	8.25	5.62
August	55.28	8.25	4.63	55.28	8.25	5.62
September	55.28	8.25	4.63	55.28	8.25	5.62
October	55.28	8.25	4.63	55.28	8.25	5.62
November	55.28	8.25	4.63	55.28	8.25	5.62
December	55.28	8.25	4.63	55.28	8.25	5.62
Average for year	55.28	8.25	4.63	55.28	8.25	5.18

[1] Quotations from Metal Statistics, 1946.
[2] Does not include Government premium of \$29.70 a ton on zinc concentrates payable for overquota production.
[3] Average price for foreign zinc converted to cents per pound with the pound sterling at \$4.02½. Official maximum price raised on June 11, 1945.

Average price received by producers for zinc, 1941–45, by grades, in cents per pound

	1941	1942 [1]	1943 [1]	1944 [1]	1945 [1]
Grade A: [2]					
Special High Grade	8.04	9.00	8.91	8.90	8.89
Regular High Grade	7.74	9.10	8.74	8.62	8.60
Grade B: Intermediate	7.52	8.64	8.71	8.74	8.66
Grades C and D: [2]					
Brass Special	7.37	8.32	8.46	8.48	8.48
Selected	6.64	8.18	7.95	8.27	8.32
Grade E: Prime Western	7.16	8.23	8.31	8.24	8.24
All grades	7.5	8.7	8.6	8.6	8.6
Prime Western; spot quotation at St. Louis	7.5	8.25	8.25	8.25	8.25

[1] Does not include overquota premium payments made by Office of Metals Reserve.
[2] American Metal Market quotes average prices of High Grade and Brass Special as follows: High Grade (f. o. b. New York)—1941, 8.48 cents; 1942, 9.25 cents (delivered); 1943, 9.25 cents (delivered); 1944, 9.25 cents (delivered); 1945, 9.25 cents (delivered). Brass Special (f. o. b. East St. Louis)—1941, 7.68 cents; 1942, 8.50 cents; 1943, 8.50 cents; 1944, 8.50 cents; 1945, 8.50 cents.

FOREIGN TRADE [3]

IMPORTS

Total imports of zinc in ores and concentrates declined 10 percent from 1944 and 29 percent from the record established in 1943. Of the 381,719 short tons of zinc imported in ores and concentrates in 1945, 46 percent came from Mexico, 24 percent from Canada, 11 percent from Bolivia, 9 percent from Peru, 6 percent from Newfoundland and Labrador, and 4 percent from Australia. The substantial gain in imports of ore from Bolivia reflected the increased activity in zinc mining there. Imports from Australia, 64 percent less than in 1944, were the only ones to reach the United States from the Eastern Hemisphere. Imports of slab zinc increased 53 percent over 1944 owing to a 157-percent gain in imports from Canada and a 222-percent increase in slab zinc from Australia, which more than offset a decline in Mexican imports.

Zinc imported into the United States in ore, blocks, pigs, or slabs, 1943–45, by countries, in short tons [1]

Country	1943	1944	1945
Ore (zinc content):			
Argentina	53,452	22,253	----------
Australia	122,305	42,216	15,377
Belgian Congo	14,835	----------	----------
Bolivia	2,760	5,305	5,771
Canada	110,310	112,299	90,200
Chile [2]	14,369	96	34,438
Mexico	166,168	177,628	177,003
Newfoundland and Labrador	32,949	19,013	23,515
Peru	21,901	43,889	35,415
Other countries	(3)	----------	----------
	539,049	422,699	381,719
Blocks, pigs, or slabs:			
Australia	2,241	4,480	14,417
Canada	8,570	18,099	46,594
Mexico	45,344	39,703	36,105
Other countries	----------	1,344	----------
	56,155	63,626	97,116

[1] Data include ore imported for immediate consumption plus material entering country under bond.
[2] Substantially all zinc shown as received from Chile originated in Bolivia and was shipped from Chilean ports.
[3] Less than 1 ton.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Zinc imported for consumption in the United States, 1941–45, by classes

Year	Ores (zinc content)		Blocks, pigs, or slabs		Sheets		Old dross and skimmings [1]		Zinc dust		Total value [2]
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1941	154, 520	$4, 596, 480	40, 288	$3, 661, 549	271	$54, 464	456	$31, 695	140	$21, 495	$8, 365, 683
1942	283, 167	10, 723, 983	36, 352	2, 924, 438	50	10, 086	3, 357	158, 929	702	43, 464	13, 860, 900
1943	516, 646	20, 475, 688	56, 155	5, 825, 874	(3)	56	5, 146	226, 754	106	17, 585	26, 545, 957
1944	415, 004	18, 678, 957	63, 626	6, 132, 877	15	2, 540	5, 603	300, 188	------	--------	25, 114, 562
1945	330, 397	14, 962, 057	96, 710	12, 165, 873	(3)	2	7, 331	477, 893	362	39, 789	27, 645, 614

[1] Includes dross and skimmings as follows—1941: 353 tons, $23,028; 1942: 3,214 tons, $150,913; 1943: 5,032 tons, $216,425; 1944: 4,694 tons, $224,995; and 1945: 4,323 tons, $231,946.
[2] In addition, manufactures of zinc imported as follows—1941: $1,099; 1942: $16; 1943: $35,355; 1944: $14,223; and 1945: $8,077.
[3] Less than 1 ton.

EXPORTS

The value of exports of zinc ores (and concentrates) and manufactured articles containing zinc of foreign and domestic origin (excluding galvanized products, alloys, and pigments) amounted to $2,956,222 in 1945 compared with $4,857,365 in 1944. Sheets, strips, or other forms replaced slabs, plates, or blocks as the principal export group. The exports of slabs, plates, or blocks declined 64 percent to the lowest level since 1939. In addition to the items shown in the accompanying tables, considerable zinc is exported each year in brass, pigments, chemicals, and galvanized iron and steel. Export data on zinc pigments and chemicals are given in this volume in the chapter on Lead and Zinc Pigments and Zinc Salts. Much of the zinc used in the manufacture of such products is of foreign origin, and when they are exported a draw-back of 99 percent of the import duty is refunded upon the basis of zinc contained in the finished product. Data covering draw-back in 1945 are not yet available. Draw-back refunds were made on 7,274 tons in 1943 and on 29,738 tons in 1944.

Slab and sheet zinc exported from the United States, 1942–45, by destinations, in short tons

Destination	Slabs, plates, and blocks				Sheets, strips, or other forms, n. e. s.			
	1942	1943	1944	1945	1942	1943	1944	1945
Country:								
Argentina	67	--------	--------	110	210	91	146	274
Australia	--------	(1)	--------	--------	558	48	--------	5
Belgium and Luxembourg	--------	--------	--------	2, 060	--------	--------	--------	(1)
Brazil	171	1, 528	1, 069	441	73	79	145	321
Canada	5, 918	13, 347	4, 132	24	1, 071	2, 160	2, 704	2, 956
Chile	429	107	17	587	476	24	18	7
China	1, 580	2, 170	--------	--------	11	5	5	2
Cuba	7	(1)	1	141	32	56	42	67
France	--------	--------	--------	2, 204	--------	--------	--------	--------
India and Dependencies	8, 896	5, 818	--------	--------	1, 026	1	4	10
Mexico	110	161	473	113	207	196	278	413
Portugal	--------	--------	--------	17	--------	--------	--------	277
Sweden	--------	--------	--------	470	--------	--------	--------	94
Switzerland	--------	--------	--------	1, 336	--------	--------	--------	110
Turkey	--------	--------	--------	3	--------	--------	--------	243
U. S. S. R	13, 439	23, 477	1, 151	--------	101	--------	--------	1
Union of South Africa	1	1, 329	--------	--------	319	144	60	186
United Kingdom	103, 086	48, 540	14, 669	--------	5	2	8	4
Other countries	234	962	64	276	678	361	610	1, 265
	133, 938	97, 439	21, 576	7, 782	4, 767	3, 167	4, 020	6, 235
Continent:								
North America	6, 073	13, 509	4, 621	300	1, 490	2, 389	3, 095	3, 509
South America	826	1, 652	1, 112	1, 391	804	317	438	1, 018
Europe	116, 525	72, 017	15, 820	6, 087	113	74	97	643
Asia	10, 480	7, 991	22	3	1, 212	13	10	364
Africa	34	2, 269	1	1	485	322	379	693
Oceania	--------	1	(1)	--------	663	52	1	8

[1] Less than 1 ton.

Zinc ore and manufactures of zinc, exported from the United States, 1941–45

Year	Zinc ore, concentrates, and dross (zinc content)		Slabs, plates, or blocks		Sheets, strips, or other forms, n. e. s.		Zinc dust	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941			89,309	$12,712,121	5,246	$1,328,516	2,901	$676,876
1942	(1)	$18	133,938	22,828,929	4,767	1,289,889	1,772	417,957
1943	1	305	97,439	17,167,729	3,167	891,132	5,859	1,263,296
1944	(1)	38	21,576	3,717,643	4,020	1,065,206	295	74,478
1945	(1)	67	7,782	1,126,910	6,235	1,747,937	330	81,308

1 Less than 1 ton.

WORLD PRODUCTION

The unconditional surrender of Germany and Japan in May and August 1945, respectively, permitted relaxation of censorship restrictions on production statistics of most of the zinc-producing countries in the world. Some information regarding the zinc industry in European countries formerly under Axis control has become available during the year, and some progress has been made toward presentation of comprehensive world zinc-production statistics during the war years. Nevertheless, a statistical gap in the record for certain important zinc-producing centers continues to prevent final compilation of production data beyond 1940.

World smelter production of zinc, 1938–45, by countries where smelted, in metric tons [1] [2]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Australia	70,941	72,363	77,176	78,945	75,474	76,972	79,979	85,118
Belgium	210,400	186,020	76,480	47,220	36,820	43,770	[3] 8,660	[3] 10,340
Canada	156,008	159,338	168,486	193,784	195,769	187,342	152,876	165,348
Czechoslovakia	8,876	(4)	(4)	(4)	(4)	(4)	(4)	(4)
France	54,713	61,019	37,843	25,918	22,829	17,770	8,367	8,064
Germany [5]	194,370	231,000	317,600	317,600	314,100	312,000	290,000	(6)
Indochina	4,470	5,439	5,352	6,237	5,272	(6)	(6)	(6)
Italy	33,367	35,398	39,338	38,800	31,551	(6)	(6)	(6)
Japan	54,203	51,256	59,703	61,092	58,198	62,280	60,551	(6)
Mexico	35,881	35,369	33,388	38,678	51,743	54,449	49,248	48,898
Netherlands	25,300	20,500	5,049	3,718	5,153	4,565	2,105	(6)
Northern Rhodesia	10,379	12,899	13,402	13,762	13,046	13,620	14,712	15,483
Norway	46,523	45,917	17,229	6,464	7,693	15,376	11,777	(6)
Poland	108,071	117,936	[7] 120,000	(6)	(6)	(6)	(6)	36,385
Spain	7,672	13,396	12,322	19,143	19,150	19,200	18,054	17,262
Union of Soviet Socialist Republics	[7] 80,000	[7] 85,000	[7] 85,000	(6)	(6)	(6)	(6)	(6)
United Kingdom [8]	56,190	52,885	60,025	68,677	72,437	70,345	73,190	63,034
United States	404,912	460,154	612,596	745,720	809,088	854,844	788,613	693,594
Yugoslavia	3,956	4,182	4,989	(6)	(6)	(6)	(6)	(6)
	1,566,000	1,650,000	1,746,000	(6)	(6)	(6)	(6)	(6)

1 In addition to the countries listed above, Argentina and Sweden also produce zinc, but complete data are not available.
2 Statistical data derived in part from the American Bureau of Metal Statistics, Yearbook.
3 Excludes electrolytic zinc production, data for which are not available.
4 Included with Germany.
5 Includes Austria; beginning in October 1938 includes Sudetenland, beginning in October 1939 includes Upper Silesia, and beginning in 1942 includes Lower Syria.
6 Data not available.
7 Estimate.
8 Some secondary metal included.

REVIEW BY COUNTRIES

Argentina.—The Aguilar mine of the Compania Minera Aguilar, S. A., subsidiary of the St. Joseph Lead Co., continued to be the leading producer in 1945, although ore production declined owing to shortage of mine timber, fuel oil, and inability of the railroad to provide enough cars for shipping the concentrates from the mine. The zinc-concentrate production at the Aguilar mine in 1945 was 25,862 metric tons, compared with 38,512 tons in 1944.

Australia.—Labor shortages, reportedly the most critical of any year since the beginning of the war, continued to restrict the production of zinc at Australian mines and smelters in 1945. At Mount Isa Mines, Ltd., Queensland, a critical manpower shortage permitted operating the copper section of the mine only. The need for adequate manpower seriously curtailed development programs at the mines.

The production of crude ore at the Broken Hill South, Ltd., for the fiscal year ended June 30, 1945, was 309,605 long tons, compared with 341,920 tons the previous year. A corresponding decrease was reported in the production of zinc concentrates. Although exploration and development were curtailed to release labor for production, the ore reserves increased slightly to 1,930,000 long tons averaging 11.1 percent zinc and 13.8 percent lead.

The Lake George Mining Corp., Ltd., at Captain's Flat, New South Wales, produced 164,549 tons of ore for the fiscal year ended June 30, 1945, compared with 239,900 tons for the previous year, the bulk of the ore for both years being taken from the Keating's ore body. The total estimated ore reserves remaining at the property on June 30 were 1,416,603 tons assaying 1.1 dwt. gold and 1.4 ounces of silver per ton and 7.3 percent lead, 12.8 percent zinc, and 0.7 percent copper.

The electrolytic plant of the Electrolytic Zinc Co. of Australasia, Ltd., at Risdon, Tasmania, which treats zinc concentrates from Broken Hill, New South Wales, as well as from the company-owned Tasmanian mines, produced 83,773 long tons of slab zinc during 1945.

Belgium.—The Belgian smelting industry made very little headway during 1945 toward resuming operations, largely owing to lack of raw materials, shortage of fuel, and delays in rehabilitating the plants. The three zinc smelters of the Société Anonyme de la Vielle Montagne began operations on a very limited scale during the middle of the year; concentrates smelted came from Sweden and the Belgian Congo. The Société Anonyme Métallurgique de Prayon smelter began producing slab zinc at approximately 6-percent plant capacity in October The Société Anonyme de Rothem smelter remained idle during the year for lack of fuel; production of slab zinc was resumed in January 1946.

Bolivia.—During 1945, 23,116 short tons of zinc (metal content of ore and concentrate) were exported, virtually all of which was produced at the Huanchaca mine of the Cia. Huanchaca de Bolivia.

Burma.—The famous Bawdwin lead-zinc mine and smelter—which before the war produced 40,000 to 50,000 long tons of zinc in concentrates a year—was recaptured from the Japanese in February 1945. Engineers of the Burma Corp., prewar operator of the property, reported the lower levels of the mine flooded and the upper levels in critical need of repairs to prevent further deterioration. The concentrating mill and a large section of the residential area were burned by the Japanese. The smelter and appurtenant installations, although suffering from disuse and neglect, were reported in fair condition. Resumption of mining and milling operations is contingent upon reconstruction of portions of the property destroyed during Japanese occupation, replacement of the hydroelectric plant which was destroyed by the British before evacuation in April 1942, permission of the Shan States to import Indian, Chinese, or Burmese labor which is at present prohibited or largely restricted, and reconstruction of the destroyed portions of the Burma Railway between Mandalay and Lashio to permit rail transportation of equipment, supplies, products, and personnel. The remaining reserves at the property are estimated at approximately 3,500,000 tons of ore averaging 15.7 ounces of silver per ton, 20.4 percent lead, 12.6 percent zinc, and 0.9 percent copper.

Canada.—Zinc production increased in Canada in 1945, despite a continued shortage of mine and smelter labor which showed little improvement until late in the year. At Trail, British Columbia, the Consolidated Mining & Smelting Co. continued to be the principal source of Canadian zinc production. Slab zinc produced at the electrolytic plant at Trail increased to 134,873 short tons from 117,365 tons in 1944. Ore reserves at the end of the year showed a net increase of about 1½ million tons. About 9,400 tons of zinc concentrates averaging 58.89 percent zinc were recovered during the year from 47,777 tons of ore milled at the Base Metals Mining Corp. property in British Columbia. The Zincton Mines, Ltd., suspended milling of ore June 1, 1945, upon expiration of its contract with the Office of Metals Reserve. Underground development continued during the summer months, and milling was resumed late in October. During the year 73,322 tons of ore were milled yielding 6,282 tons of zinc (metal content of concentrates).

The Hudson Bay Mining & Smelting Co., Ltd., at Flin Flon, Manitoba, produced 1,822,979 short tons of ore in 1945, the smallest output since 1940. About 140,870 tons of zinc concentrates averaging 45.55 percent zinc were produced at the company's flotation mill. Slab-zinc production at the company's electrolytic plant was 47,468 tons compared with 56,552 tons in 1944. Ore reserves to the 3,500-foot level, as of December 31, 1945, were reported to be 26,000,000 tons averaging 0.089 ounce of gold and 1.25 ounces of silver per ton, 4.24 percent zinc, and 2.99 percent copper. At Sherridon, Manitoba, the Sherritt Gordon Mines, Ltd., milled 646,092 tons of ore in 1945, of which 363,350 tons were from the West mine and 282,742 tons from the East mine. Zinc-ore reserves (East ore body) were reported at the end of the year to be 33,500 tons averaging 8.66 percent zinc compared with 113,000 tons containing 9.04 percent zinc at the end of the previous year. Ore reserves in the West mine at the end of 1945 were 1,908,500 tons averaging 2.24 percent zinc and 2.66 percent copper.

The Normetal Mining Corp., Ltd., at Normetal, Quebec, milled 204,067 tons of ore during the year averaging 3.68 percent copper and 7 percent zinc, which yielded 19,297 short tons of zinc concentrate (52.90 percent zinc) in addition to copper concentrate. Ore reserves at year end were 1,399,000 tons averaging 7.04 percent zinc and 3.53 percent copper. Ore reserves at the Waite Amulet Mines, Ltd., were reduced from 2,986,555 tons in 1944 to 2,517,538 tons at the end of 1945. The New Calumet Mines, Ltd., at Calumet Island, Quebec, reported ore reserves on November 1, 1945, at 1,011,200 tons assaying 9.1 percent zinc, 2.9 percent lead, and 5.76 ounces of silver and 0.038 ounce of gold per ton.

France.—The mine output of zinc in France increased 176 percent in 1945 largely owing to removal of German control of the industry early in the year. Production of zinc (content of zinc in ores and concentrates) from 1938 through 1945, in metric tons, was as follows:

Year	1938	1939	1940	1941	1942	1943	1944	1945
Production	95	500	1,420	3,055	3,215	2,648	2,387	6,599

Zinc-producing mines which operated during the year include the Pierrefitte and Sentein mines in the Pyrenees.

Germany.—The chief sources of zinc ores in Germany are Upper Silesia, the Harz Mountains, and along the Rhine River in the Provinces of Rheinland, Westphalia, and Baden. The mine production of recoverable zinc from German properties from 1938 through 1943, in metric tons, was as follows:

Year	1938	1939	1940	1941	1942	1943
Production	158,336	158,527	210,918	229,499	224,061	238,555

Italy.—Of the four zinc smelters in Italy, only one—the Porto Marghera electrolytic plant—was so damaged during the war as to prevent immediate resumption of operations.

Mexico.—There were relatively few difficulties between labor and management at Mexican mines during the year until the increased selling price for Mexican silver in the United States was announced in September. Shortly thereafter labor unions presented demands for a 40-percent wage increase; to enforce these demands, a general strike of mine and smelter labor was called on December 31. Heavy taxes and poor railroad facilities and service continued to restrict Mexican zinc production.

Newfoundland.—The mine production of zinc, in terms of zinc content of concentrates produced, totaled 49,350 short tons in 1945 compared with 59,472 tons in 1944. The bulk of the concentrates continued to be exported to the United States.

Peru.—The mine production of zinc in Peru decreased approximately 22 percent in 1945 largely because purchase contracts by the United States Government agencies were canceled and there was consequent uncertainty regarding markets.

Poland.—The Polish zinc industry is controlled and operated by the Zjednoczenie Przewyslu Cynkowego (Union of the Zinc Industry), which in turn is controlled by the Central Management of the Smelting Industry. Investments of the individual companies were nationalized early in 1946 and rearranged into 14 operating units, each consisting of a mine or smelter or both. Each unit has a local manager, who supervises routine operations, and a labor council to govern labor policies. Preliminary data covering the Polish zinc-smelting industry in 1945 indicate a production of 36,385 metric tons of slab zinc recovered from 71,607 tons of concentrates treated at the four operating smelters.

Spain.—The production of zinc concentrates in 1945 was reported to be 52,402 metric tons (60,178 tons in 1944) and of slab zinc 17,262 tons (18,054 tons in 1944). Exports of slab zinc, all to Portugal, totaled 800 tons. The Asturiana zinc smelter at Arnao, near Avilés, accounted for all the zinc produced in 1945; the smelter at Peñarroya, Province of Cordoba, closed at the end of 1944, remained idle throughout 1945.

United Kingdom.—Consumption of zinc in the United Kingdom totaled 250,383 long tons in 1945, of which 173,323 tons were primary zinc and 77,060 tons secondary (including remelted) zinc. Comparable figures for 1944 were 308,916 tons consumed, of which 184,241 tons were primary and 124,675 tons secondary. Of the total zinc consumed in 1945, 43 percent was used in brass products, 19 percent in galvanizing, 14 percent in zinc oxide, 10 percent in rolled zinc, 7 percent for die castings, and 7 percent for zinc dust and miscellaneous uses.

U. S. S. R.—Virtually no official production figures have been available on the Russian zinc industry during the last 7 years. Data, however, presented in the announcement March 1946 of the new Five Year Plan indicate that zinc output has been declining in recent years.

Yugoslavia.—The properties of the Trepca Mines, Ltd., were recovered intact from the Germans in May 1945. Operation of the mine during German occupation was such, according to reports, as to substantially reduce ore reserves and damage much of the plant and equipment. Production on a limited scale was resumed in July 1945, and the output was shipped to Russia.

LEAD AND ZINC PIGMENTS AND ZINC SALTS

By Helena M. Meyer and Alethea W. Mitchell

SUMMARY OUTLINE

GENERAL SUMMARY

Although hostilities with Germany and Japan ended in 1945, other factors were such that the pigments industry could not do much toward filling the large pent-up civilian demand for products covered by this report. War requirements for pigments continued large for more than half of the year, and civilian needs were not adequately supplied, but shipments of lead and zinc pigments as a group trended downward. The down-trend thus is not explained by the lack of demand for the products but rather by continued shortages, in varying degree, of materials that were inadequate in earlier war years. For most of the year supplies of lead and zinc pigments, and titanium pigments as well, were insufficient to meet war and civilian needs. The outstanding shortages in 1945 were of lead, particularly for the manufacture of white lead, and of linseed oil, although supplies of other drying oils likewise were inadequate for requirements. Had adequate quantities of the necessary crude materials, that is, lead and zinc metal, drying oils, and containers, and of labor, been available, the pigments industry would have produced much higher tonnages than it did.

The stepped-up tempo of the war early in the year led to more stringent controls on pigments and linseed oil at the time; leaded zinc oxide, for example, was subjected to distribution control in February for the first time in the war. White lead bore the brunt of curtailment in the use of lead in 1945 as lead became one of the most critical materials in the United States from an immediate supply point of view. The seeming favoritism toward other lead chemicals is explained by the fact that substitutes for white lead as a paint pigment could fill the needs for white lead more satisfactorily than could any substitutes for lead in uses such as storage batteries.

After VJ-day larger allotments of pig lead were made to the white-lead industry; and, in addition, restrictions on the end uses of white lead were removed. These actions proved to be premature, however, because the lead supply did not improve, and at the end of the year the outlook for obtaining sufficient metal in the near future for all needs was gloomy. As a consequence, allowances of lead to the pigment industry were reduced again in the first quarter of 1946. All zinc restrictions were removed after the Japanese surrender. Pigment makers, however, continued to find it difficult at times to obtain zinc slabs.

Previous reports of this series have pointed out that although supplies of zinc metal in relation to requirements were less plentiful than were those of lead early in the war, the relationships were reversed as the war progressed. This reversal was accentuated in 1945, and at the end of the year lead was one of the few commodities whose disposition continued to be controlled by the Civilian Production Administration (War Production Board until November 1, 1945). The raw material needs for making lead pigments are met almost entirely by metal, whereas those for zinc pigment manufacture, particularly for leaded zinc oxide and lead-free zinc oxide, come largely from ores. This difference has favored zinc pigments during the war period because supplies of ore were more abundant than were those of either metal.

One of the chief outlets for pigments, of course, is in the manufacture of paints. Sales of paint, varnish, and lacquer materials, figures on which are compiled by the United States Department of Commerce, established a new high record in 1945 for the third successive year, rising 4 percent above the previous peak in 1944. The value of sales for 680 establishments that contributed approximately 90 percent of the total value of the industry as reported in the Census of Manufactures for 1939 was $644,429,374 in 1945 compared with $618,325,532 in 1944.

Production and sales of titanium pigments, which normally compete for markets supplied by lead and zinc pigments, were again at new record high levels in 1945, continuing the long-time trend. The peak output was inadequate for requirements, and plant-capacity limitations prevented production expansion to cover total demand. Production capacity is to be expanded in 1946. The Bureau of Mines is not at liberty to publish figures covering titanium pigments.

Some of the features of the lead and zinc pigments and zinc salts industries in 1945 are outlined below. It should be borne in mind that many of the trends indicated were due to factors other than those of supply and demand for the finished products themselves, i. e. the restrictions on the use of lead in pigments or other restrictions. Shipments of litharge in 1945 were slightly above the previous peak for 1944 and those for zinc sulfate exceeded the previous peak for this commodity in 1941 by 9 percent. Consumption of litharge in the manufacture of storage batteries in 1945 was a new peak level for the third successive year, but the manufacture of black oxide by the storage-battery makers themselves declined from 1944 and the use of red lead for battery purposes likewise was below the peak for 1944 although comparing favorably with other earlier years. Despite the record sales of paints, varnish and lacquer materials in 1945 smaller

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quantities of most of the pigments covered by this report went into the manufacture of paints. Shipments of zinc oxide were an exception in registering a gain of 12 percent. The use of zinc oxide for chemical warfare purposes assumed importance in 1943, reached a peak of 27,686 tons in 1944 but in 1945 with the completion of the program amounted to only 7 percent of the record tonnage. The agricultural use of litharge declined 30 percent from the record high level established in 1944 but was at a relatively high rate as compared with other earlier years. Consumption of zinc oxide in the manufacture of floor coverings and textiles in 1945 appears to have been at a higher rate than ever before, although the statistical record covers the period 1929–45 only. The manufacture of ceramics has taken reduced quantities of lead and zinc pigments in recent years and took less in 1945 than the somewhat increased quantities in 1944. Zinc oxide consumption in ceramics, however, gained 39 percent over 1944 in contrast to the performance of other pigments covered by this report. Chrome pigments took 38 percent more litharge in 1945 than in 1944 and thus probably established the second-highest annual record for this class. Chrome pigments were governed by the restrictions for chrome rather than by those for lead.

Salient statistics of the lead and zinc pigments industry of the United States, 1940–45

	1940	1941	1942	1943	1944	1945
Production (sales) [1] of principal pigments:						
White lead (dry and in oil) short tons	80,562	113,000	83,639	76,167	85,726	51,170
Litharge do	89,841	122,280	91,513	113,091	138,203	138,798
Red lead do	42,200	53,838	48,369	53,378	53,972	47,381
Zinc oxide do	113,213	148,833	99,677	143,402	140,675	127,955
Leaded zinc oxide do	45,362	68,920	48,128	43,828	64,395	62,598
Lithopone do	151,802	176,642	137,320	135,723	142,905	136,161
Value of products:						
All lead pigments	$32,628,000	$46,572,000	$39,393,000	$41,897,000	$46,601,000	$39,045,000
All zinc pigments	28,747,000	39,210,000	30,785,000	36,260,000	39,288,000	36,644,000
Total	61,375,000	85,782,000	70,178,000	78,157,000	85,889,000	75,689,000
Value per ton received by producers:						
White lead (dry)	$137	$147	$160	$163	$163	$159
Litharge	126	134	150	152	146	148
Red lead	141	161	171	171	164	168
Zinc oxide	118	125	138	137	139	138
Leaded zinc oxide	114	118	129	132	132	132
Lithopone	67	71	79	79	78	78
Foreign trade:						
Lead pigments:						
Value of exports	$594,000	$1,228,000	$957,000	$1,439,000	$1,387,000	$1,421,000
Value of imports	14,000	12,000	4,000	3,000	6,000	8,000
Zinc pigments:						
Value of exports	1,585,000	3,525,000	2,741,000	2,737,000	2,017,000	2,279,000
Value of imports	46,000	22,000	8,000	5,000	1,500	(2)
Export balance	2,119,000	4,719,000	3,686,000	4,168,000	3,396,500	3,692,000

[1] Reported as shipments in 1945.
[2] Less than $500.

The Eagle-Picher Co. acquired an interest in the MacArthur, Irwin, Ltd., Montreal, Canada, in 1945, and immediate plans were made for expanding white-lead activities and for extending operations to the production of litharge and red lead. The National

Lead Co., through its subsidiary, Canada Metal Co., Ltd., Toronto, was reported to have completed plans in 1945 for construction of a plant for the manufacture of lead oxides. Through Canadian Titanium Pigments, Ltd., Montreal, the National Lead Co. is also interested in production in Canada of titanium dioxide.

Government controls.—On January 15, 1945, the lead pigments covered by this report (except litharge for storage-battery manufacture which remained under War Production Board Order M–38) were placed under a new chemicals order, M–384. Provisions of the chemicals order were described in the report of this series for 1944. Amendments to the order provided for the liberalization of allowances to pigment manufacturers after VJ-day and removed end-use limitations on lead in the production of chemicals by establishing an over-all quota for making these chemicals. Producers were restricted to a maximum quota of 55 percent of the aggregate quantity of lead put into process for the output of lead chemicals during the first 6 months of 1944. Thus greater flexibility in the production of chemicals was permitted. In mid-December M–384 was revoked and the chemicals were incorporated under the lead order, M–38. At that time the over-all percentage of lead allowed for chemicals was reduced from 55 to 48 percent.

Zinc metal and oxide controls were described in the report of this series for 1944. For the first time leaded zinc oxide was put under distribution control in February 1945 in a revision of Order M–11–a. Lithopone, titanated lithopone, titanium dioxide, and zinc sulfide were transferred in April from Order M–353 to M–340, with no changes in the provisions for authorized deliveries of these products. Zinc restrictions were removed following VJ-day.

Future prospects for consumption.—As has been pointed out in previous reports of this series, the potential consumption of pigments in the near future is great due to pent-up demand for houses, automobiles, and many other products that require large quantities. Recent discussions on certain aspects of the subject are outlined below. A high level of construction was recently forecast.[1] Assuming reasonable costs and close cooperation between all segments of the industry the beginning of a potential construction boom was expected in 1946. A forecast of 7.5 billion dollars of new construction and 5 billion of repair and maintenance compared with a total for the two classes of 9.2 in 1945. New construction was expected to be almost 60 percent above 1945 and to represent the highest volume registered since 1929, except for the war years. Veterans' requirements were said to exceed the total new houses that could be built, so that the housing shortage in the United States was expected to continue. The new construction rate in 1947 was forecast as 12 billion dollars. Concannon [2] said that the paint industry, which was comparatively free of reconversion problems in a technical sense, awaits only two things—first, increased supplies of certain essential materials and, second, a resurgence in demand for its products. He said that the supply of linseed oil loomed as the most vital factor in

[1] Shaw, Wm. H., Prospects for Construction: Domestic Commerce, vol. 34, No. 1, January 1946, pp. 9 and 29.
[2] Concannon, C. C., Industrial Trends in 1946 Discussed: Domestic Commerce, vol. 34, No. 1, January 1946, p. 6.

the coming months and that the supply of pigments was becoming more abundant, except for titanium dioxide and white lead. The futures of lead, zinc, and titanium pigments were discussed at the 1945 Convention-at-Home of the National Paint, Varnish and Lacquer Association, Inc., and were published thereafter.[3] Wormser's prediction that

> The white-lead industry expects to be back to a full prewar basis before the year end closes and both white lead in oil and dry white lead should again become plentiful

was not possible of accomplishment because supplies of lead in relation to demand therefor became less rather than more abundant. Actually reduced quantities of lead were permitted white lead manufacturers for the first quarter of 1946. Pickens said that

> Since the productive capacity of the titanium industry is not capable of meeting the demand for its products, the general outlook ahead is one of tight supply with the biggest single problem of the industry revolving around how soon additional productive facilities can be constructed and put into operation.

Gent felt that the capacity of the zinc pigments industry was adequate to take care of the anticipated large demand.

Bureau of Standards Simplified Practice Recommendation R144-43, Paints, Varnishes, and Related Products (colors and containers) was revised and became effective November 1, 1945, as R144-45. This revision provided for an increased number of colors and for some additional container sizes.

PRODUCTION

Figures on sales have been used in this series for many years as a better guide than production to activity in the pigments industry. If lead or zinc pigments are made from ores, statistics are gathered now by the Bureau of Mines on the lead and zinc questionnaires. These forms call for shipments rather than sales; and, for the sake of uniformity, the pigments schedule has been revised to call also for shipments. Available data make it appear that there was little difference between shipments and sales in 1945. An attempt is made to avoid all duplication in reporting pigment tonnages. One main method is elimination of products used in blending into another pigment from figures for the original class. Basic lead sulfate and zinc oxide that are blended to make leaded zinc oxide, for example, are shown under the last-named class only. Pigments consumed by the producing companies to make products beyond those covered by this report—that is, paint, storage batteries, and other articles—are considered as shipments.

The value of lead and zinc pigments in 1945 totaled $75,689,000, a decline of 12 percent from 1944. Lead pigments represented 52 percent of the total and zinc pigments 48 percent, compared with 55 and 45 percent, respectively, in 1939.

[3] Wormser, Felix, What's Ahead in Raw Materials—Lead Pigments: Paint Industry Mag., vol. 60, No. 11, November 1945, p. 372.
Gent, E. V., What's Ahead in Raw Materials—Zinc Pigments: Paint Industry Mag., vol. 60, No. 12, December 1945, p. 410.
Pickens, Dennis K., What's Ahead in Raw Materials—Titanium Pigments: Paint Industry Mag., vol. 61, No. 1, January 1946, p. 11.

LEAD PIGMENTS

Production and shipments of lead pigments were adversely affected by restrictions of the lead chemicals order, as previously indicated, and total shipments declined 15 percent; they were, however, 3 percent above 1939. In both relationships lead pigments fared worse than zinc pigments. The high sales records established for litharge in recent years and the relatively high level of red-lead sales prevented a further decline in total lead pigments sales in 1945 in relation to 1944 and caused the increase as compared with 1939; white-lead sales have made a poor showing, which in 1945 particularly was due to circumstances beyond the control of the industry. The value of shipments of lead pigments fell 16 percent in 1945 as compared with 1944 but rose 10 percent as compared with 1939. In value of shipments, lead pigments gained less in 1945 as compared with 1939 than zinc pigments. There were some variations in producers average per ton values between 1944 and 1945, probably explained by shifts in delivery points, inasmuch as average quoted prices remained unchanged from 1944 levels.

Lead pigments sold [1] by domestic manufacturers in the United States, 1944–45

Pigment	1944			1945		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Basic lead sulfate or sublimed lead:						
White	5, 253	$765, 566	$146	2, 235	$318, 900	$143
Blue	1, 080	147, 255	136	1, 660	237, 890	143
Red lead	53, 972	8, 840, 366	164	47, 381	7, 963, 888	168
Orange mineral	284	70, 154	247	230	59, 906	260
Litharge	138, 203	20, 207, 218	146	138, 798	20, 566, 670	148
White lead:						
Dry	46, 466	7, 570, 239	163	27, 382	4, 346, 124	159
In oil [2]	39, 260	9, 000, 291	229	23, 788	5, 552, 118	233

[1] Reported as shipped in 1945.
[2] Weight of white lead only but value of paste.

Lead pigments sold [1] by domestic manufacturers in the United States, 1941–45, in short tons

Year	White lead		Basic lead sulfate or sublimed lead		Red lead	Orange mineral	Litharge
	Dry	In oil	White	Blue			
1941	54, 689	58, 311	8, 739	1, 631	53, 838	246	122, 280
1942	35, 865	47, 774	7, 229	1, 181	48, 369	128	91, 513
1943	39, 525	36, 642	4, 752	845	53, 378	79	113, 091
1944	46, 466	39, 260	5, 253	1, 080	53, 972	284	138, 203
1945	27, 382	23, 788	2, 235	1, 660	47, 381	230	138, 798

[1] Reported as shipped in 1945.

ZINC PIGMENTS AND SALTS

Although zinc metal and scrap were in scarcer supply than lead in the early days of the war—a condition resulting in greater limitations on supplies of zinc pigments that are made from metal—the situation was reversed in 1945, and zinc pigments fared better than lead pigments. Throughout the war American Process zinc oxide and leaded zinc oxide, because they are made from ores, were more abundant than most of the other products covered by this report. Leaded zinc oxide shipments were at a high though not record level in 1945, and those for zinc oxide compared favorably with other years except 1941, 1943, 1944, and several years in the late twenties. Sales of lithopone in 1945 were 5 percent less than in 1944 and the same percentage below 1939. Zinc pigments as a group dropped 6 percent in tonnage below 1944 but were still 9 percent over 1939. In value zinc pigments were 7 percent less than in 1944 and 27 percent higher than in 1939. The average per ton values of zinc pigments in 1945 were almost identical with those in 1944, as was to have been expected in view of the failure of average quoted prices to change from 1944 levels.

Shipments of zinc chloride totaled 56,230 tons (50° B.) and were at virtually the 1944 level. Zinc sulfate sales were 22 percent higher than the 1944 rate and 9 percent above the previous peak in 1941.

Zinc pigments and salts sold [1] by domestic manufacturers in the United States, 1944–45

Pigment or salt	1944			1945		
	Short tons	Value (at plant, exclusive of container)		Short tons	Value (at plant, exclusive of container)	
		Total	Average		Total	Average
Zinc oxide [2]	140,675	$19,582,487	$139	127,955	$17,708,795	$138
Leaded zinc oxide [2]	[3] 64,395	8,496,579	132	[3] 62,598	8,290,073	132
Lithopone	142,905	11,208,891	78	136,161	10,645,316	78
Zinc chloride, 50° B	57,545	3,089,837	54	56,230	2,828,474	50
Zinc sulfate	17,156	1,431,487	83	20,854	1,712,058	

[1] Reported as shipped in 1945.
[2] Zinc oxide containing 5 percent or more lead is classed as leaded zinc oxide.
[3] Includes a small quantity containing less than 5 percent lead.

Zinc pigments and salts sold [1] by domestic manufacturers in the United States, 1941–45, in short tons

Year	Zinc oxide	Leaded zinc oxide	Lithopone	Zinc chloride (50° B.)	Zinc sulfate
1941	148,833	68,920	176,642	(2)	19,201
1942	99,677	48,128	137,320	52,374	14,331
1943	143,402	[3] 43,828	135,723	53,707	15,649
1944	140,675	[3] 64,395	142,905	57,545	17,156
1945	127,955	[3] 62,598	136,161	56,230	20,854

[1] Reported as shipped in 1945.
[2] Data not available.
[3] Includes a small quantity containing less than 5 percent lead.

CONSUMPTION BY INDUSTRIES

WHITE LEAD

White lead was called upon by the provisions of the War Production Board's chemicals order, M–384, to bear the brunt of curtailment in the use of lead in 1945. In consequence, shipments of white lead, dry, declined 41 percent and were the smallest since 1934, and those for white lead in oil fell 39 percent and were the smallest since considerably before the beginning of the present century. The drop in shipments of white lead was in contrast to the peak sales of paints, varnish, and lacquers in 1945, in the manufacture of which well over 90 percent of the total white lead is used regularly. Barring restrictions, white lead shipments undoubtedly would have advanced instead of falling sharply in 1945. The use of white lead for ceramics in 1945 was at an even lower rate than the sharply reduced levels of recent years. A more precise break-down of the Other classification undoubtedly would increase the quantity shown under Paint.

Distribution of white lead (dry and in oil) sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Paint	100,665	76,837	66,441	79,948	46,418
Ceramics	3,704	1,812	1,444	946	839
Other	8,631	4,990	8,282	4,832	3,913
	113,000	83,639	76,167	85,726	51,170

[1] Reported as shipments in 1945.

BASIC LEAD SULFATE

Basic lead sulfate was included with basic carbonate white lead in the provisions of Order M–384, and thus production and shipments of this pigment were cut sharply in 1945. Shipments declined 38 percent from 1944 and were the smallest on record since the first statistics were published in 1902. Basic sulfate, likewise, is used chiefly in paints. A substantial quantity of this pigment is used regularly as an intermediate product in the manufacture of leaded zinc oxide, which is also used chiefly in paints. The basic lead sulfate used thus in blending is included in this report in the quantities shown for leaded zinc oxide and not in the figures for basic sulfate. In 1945, 8,900 tons of basic lead sulfate were sold for use in making leaded zinc oxide, compared with 7,800 tons in 1944.

Production of basic lead sulfate totaled 4,242 tons in 1945, compared with 4,605 tons in 1944.

Distribution of basic lead sulfate sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Paints	9,285	7,733	4,802	5,496	3,009
Rubber	200	89	131	268	200
Storage batteries	8		3	2	
Other	877	588	661	567	686
	10,370	8,410	5,597	6,333	3,895

[1] Reported as shipments in 1945.

RED LEAD

Red-lead sales have remained high during the war owing to the applicability of this pigment as a construction paint and to its use in the manufacture of batteries. Shipments in 1945 were reduced by the restrictions of the chemicals order, M-384, rather than by a slowing in demand for red lead. Total shipments of this pigment were 12 percent below the peak rate in 1944 and the smallest since 1940 but compared favorably, nonetheless, with years before 1941. The tonnage of red lead used in storage batteries, although 12 percent below the peak rate in 1944, was close to the high average for 1940–43. Paints took 9 percent less red lead in 1945 than in 1944 and 26 percent less than the high record rate in 1943, but the quantity had probably not been exceeded prior to 1941. The use of red lead in ceramics fell 29 percent below 1944, when the rate was relatively low as compared with 1939–41.

Production of red lead amounted to 48,185 tons in 1945 compared with 53,398 tons in 1944.

Distribution of red lead sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Storage batteries	27,405	23,545	26,616	30,211	26,725
Paints	20,130	21,017	22,271	18,074	16,438
Ceramics	1,593	939	622	878	626
Other	4,710	2,868	3,869	4,809	3,592
	53,838	48,369	53,378	53,972	47,381

[1] Reported as shipments in 1945.

ORANGE MINERAL

The small-tonnage orange mineral dropped 54 tons in 1945, which was accounted for in shipments to the principal use, color pigments. The manufacture of ink took 63 tons in 1945 compared with 56 tons in 1944.

Distribution of orange mineral sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Color pigments	26	7	8	205	151
Ink manufacture	98	93	49	56	63
Other	122	28	22	23	16
	246	128	79	284	230

[1] Reported as shipments in 1945.

LITHARGE

Shipments of litharge in 1945 exceeded by a slight margin the previous peak rate for 1944, largely because consumption in storage batteries continued at record heights for the third successive year. Allowances for the use of litharge in storage batteries, control of which was retained under the lead order, M-38, were more generous than for most lead chemicals, and this use took 58 percent of the total litharge shipped in 1945. Chrome pigments, which were restricted because of their chrome rather than lead content, took 38 percent more litharge in 1945 than in 1944, and oil refining took 14 percent more. Shipments for all other purposes declined in 1945 as compared with 1944. In addition to the litharge used to make batteries, the storage-battery manufacturers themselves produce a black or suboxide of lead which they use as a substitute for litharge. The quantity so used in 1945—56,000 tons—was 8 percent below the record tonnages for 1944 and 1941. In 1945, 53,000 tons of pig lead were required to manufacture the suboxide, compared with 58,000 tons in 1944. Black oxide figures are not included in the Bureau of Mines totals for litharge. Although the quantity of litharge used to make insecticides declined 30 percent in 1945, the total for that year had been exceeded only in 1937, 1941, 1943, and 1944. Consumption of litharge in ceramics was reduced 7 percent in 1945 but exceeded prewar levels.

Distribution of litharge sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Storage batteries	49,847	43,630	54,984	72,342	79,981
Insecticides	19,403	14,830	20,236	25,957	18,061
Ceramics	18,285	9,525	9,866	12,381	11,511
Chrome pigments	13,927	7,344	9,351	8,233	11,394
Oil refining	6,749	4,771	5,227	5,608	6,419
Varnish	3,165	3,423	3,453	2,988	2,752
Rubber	3,968	3,460	4,302	3,023	1,864
Linoleum	647	343	98	117	115
Other	6,289	4,187	5,574	7,554	6,701
	122,280	91,513	113,091	138,203	138,798

[1] Reported as shipments in 1945.

ZINC OXIDE

Although shipments of zinc oxide fell 9 percent in 1945, all normal peacetime uses made gains over 1944. The chemical warfare program, insofar as zinc oxide is concerned, was completed in 1945, and shipments for this purpose were only 7 percent of the peak for 1944. Total 1945 shipments were 14 percent below the wartime peak of 1941 but were relatively high, nonetheless, except when compared with war years other than 1941, 1943, and 1944 and the period of industrial activity in the late twenties. The rubber industry again stood out as a user of zinc oxide, taking 50 percent of total shipments. As pointed out in the chapter of this series for 1944, the manufacture of synthetic rubber requires a smaller percentage of zinc oxide than natural rubber. A return to the production of large quantities of natural rubber can be expected to call for increasing quantities of zinc oxide. Use of zinc oxide in paints was high in 1945, despite the fact that adequate supplies were not available and substitutes had to be accepted in part for uses such as paints. Floor coverings and textiles made the best showing in 1945, rising 27 percent over 1944 and probably establishing a new peak rate, although statistics are available for the period 1929–45 only. Ceramics, another use that was adversely affected by the war, made the largest percentage gain in 1945, but the quantity used in that year was exceeded in 1941 and in a number of earlier years. Of the total shown for floor coverings and textiles in the accompanying table, 9,873 tons were for coated fabrics and textiles and 2,034 tons for floor coverings compared with 7,585 and 1,978 tons, respectively, for 1944.

Production of lead-free oxide amounted to 139,374 tons compared with 152,366 tons in 1944. Of the total for 1945, 77 percent was made by the American process from ores and primary residues, 15 percent by the French process from metal and scrap, and 8 percent by other processes, compared with identical percentages in 1944.

Distribution of zinc oxide sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Rubber	90, 429	52, 717	67, 898	59, 518	63, 447
Paints	30, 304	25, 122	29, 852	24, 999	28, 014
Floor coverings and textiles	6, 991	5, 224	6, 633	9, 563	12, 177
Ceramics	8, 596	2, 934	3, 203	3, 653	5, 086
Chemical warfare			21, 801	27, 686	2, 053
Other	12, 513	13, 680	14, 015	15, 256	17, 178
	148, 833	99, 677	143, 402	140, 675	127, 955

[1] Reported as shipments in 1945.

LEADED ZINC OXIDE

Shipments of leaded zinc oxide continued at a high level in 1945 despite the decline of 3 percent from 1944. Except for 1944 and the peak year 1941 shipments in 1945 had never been exceeded. As has been pointed out previously the fact that this pigment is made almost exclusively from ore has favored its production and use during the war period. Leaded zinc oxide has benefited from business diverted from other pigments and even so greater sales of leaded zinc oxide doubtless could have been made had larger quantities been available. Although leaded zinc oxide was previously without restrictions it was subjected to delivery controls under an amplification of the zinc order M–11–a of the War Production Board in February 1945. All zinc restrictions were removed after VJ-day. Leaded zinc oxide continued to be used almost entirely in the manufacture of paints in 1945. The figures for leaded zinc oxide include basic lead sulfate used in blending, as is indicated under Basic Lead Sulfate.

Leaded zinc oxide production totaled 62,519 tons in 1945 compared with 64,432 tons in 1944. The totals can be broken down as follows (comparison with 1944 in parentheses): Over 5–35 percent lead, 48,678 (52,022) tons; over 35–50 percent, 10,091 (8,364) tons; and most of the remainder in both years, 5 percent or less.

Distribution of leaded zinc oxide sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Paints	67, 472	47, 052	42, 303	62, 223	58, 852
Rubber	1		42	119	200
Other	1, 447	1, 076	1, 483	2, 053	3, 546
	68, 920	48, 128	43, 828	64, 395	62, 598

[1] Reported as shipments in 1945.

LITHOPONE

The lithopone statistics in this report are given on the basis of ordinary lithopone sold as such plus the ordinary lithopone content of the high-strength product. This method of publication is used to conceal the operations of one company which always dominates the output of the high-strength product and is the only producer in some years. In 1945 two companies, operating three plants, produced high-strength lithopone. The second-largest maker in 1944 produced none of the high-strength product in 1945. Total shipments of lithopone declined 5 percent in 1945. Sales for paint, which regularly make up three-quarters of the total, influenced by the peak record for the paint industry in 1945 rose slightly against the trend for the total, and those for floor coverings and textiles gained 7 percent; shipments to rubber manufacturers likewise increased but represented only a small fraction of the total. Separation of the quantities of lithopone shipped for floor coverings and textiles, based on somewhat incomplete data, indicates that 10,671 tons were for floor coverings (compared with 9,578 in 1944) and 5,150 for coated fabrics and textiles (compared with 5,168 tons in 1944). Floor coverings thus were responsible for the rise in the total for the two classes, and coated fabrics and textiles were virtually unchanged. The use of lithopone in the manufacture of paper has been on the increase but was cut in less than half in 1945 when 3,086 tons were shipped for this purpose contrasted with 6,488 tons in 1944. The total for 1944 was the largest for 1936–45 for which separate statistics are available, and that for 1945 was the smallest since 1939. Shipments reported for use in the manufacture of printing inks likewise dropped sharply in 1945. A tonnage sold for ink is not separable from that for paints, but figures for identical companies show a reduction in shipments for the manufacture of ink from 1,216 tons in 1944 to 864 tons in 1945. Exports are included mainly under Other, but at least one company classifies part of its exports according to end use.

Plant capacity for the production of lithopone was reported to total 153,000 tons in 1945 or virtually the same as the 155,000 tons for 1944.

Production of lithopone totaled 136,460 tons compared with 133,960 tons in 1944.

Distribution of lithopone sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945
Paints, etc.	[2] 132,691	[2] 109,216	[2] 103,860	[2] 108,800	[2] 109,398
Floor coverings and textiles	21,114	15,775	15,999	14,746	15,821
Rubber	3,547	1,047	1,078	726	977
Other	19,290	11,282	14,786	18,633	9,965
	176,642	137,320	135,723	142,905	136,161

[1] Reported as shipments in 1945.
[2] Includes a quantity, not separable, used for printing ink.

Consumption of ordinary lithopone in the production of titanated lithopone reached a peak in 1937 when 19,400 tons were used. Since 1937 there has been an almost continuous decline, culminating in the consumption of only 7,800 tons for this purpose in 1945. Titanated lithopone usually contains about 15 percent TiO_2. The lithopone figures in the following table are included in the totals for ordinary lithopone in the preceding table.

Titanated lithopone produced in the United States and ordinary lithopone used in its manufacture, 1941–45, in short tons

Year	Titanated lithopone produced	Ordinary lithopone used	Year	Titanated lithopone produced	Ordinary lithopone used
1941	16,800	14,100	1944	9,800	8,300
1942	11,700	9,900	1945	9,200	7,800
1943	9,800	8,400			

ZINC SULFIDE

In 1945, as in several earlier years, only one company produced zinc sulfide, and the Bureau of Mines is not at liberty, therefore, to publish figures for this pigment.

ZINC CHLORIDE

Shipments of zinc chloride, in terms of 50° B. solution, totaled 56,230 tons in 1945 compared with 57,545 tons in 1944. These figures include the zinc chloride equivalent of zinc ammonium chloride and of chromated zinc chloride produced. Complete figures covering distribution of zinc chloride shipments by uses are not available.

ZINC SULFATE

Zinc sulfate shipments in 1945 were larger than ever before, exceeding those for 1944 by 22 percent and those for the previous peak year, 1941, by 9 percent. The manufacture of rayon, the outstanding use, accounted for nearly one-third of the total shipments and took 13 percent more than the previous peak tonnage for 1944. The agricultural use of zinc sulfate almost equaled that for rayon in 1945 by rising 34 percent over 1944 and likewise established a new peak rate. The use classed as Chemicals rose also in 1945, but a better breakdown of this classification undoubtedly would increase quantities shown under other classes. Of the other uses, no significant movement is noted other than the drop to less than half in the quantity for Paints, etc. This use had been making steady gains until 1944, when noteworthy declines began.

In 1945, for the first time, shipments of zinc sulfate are available on a dry basis. The details are shown in the following table, which also covers the gross weight of the product.

Distribution of zinc sulfate sales,[1] 1941–45, by industries, in short tons

Industry	1941	1942	1943	1944	1945	
	Gross weight	Gross weight	Gross weight	Gross weight	Gross weight	Dry basis
Rayon	5,170	3,149	4,537	5,954	6,729	2,922
Agriculture	3,038	4,123	3,329	4,974	6,645	3,881
Chemicals	5,555	2,595	1,642	1,459	2,617	1,749
Flotation reagent	312	355	1,282	1,131	1,232	415
Paints and varnish processing	1,422	1,917	2,439	1,330	589	275
Textile dyeing and printing	130	60	213		534	474
Glue	1,203	750	635	293	260	104
Electrogalvanizing	502	219	187	278	255	161
Other	1,869	1,163	1,385	1,737	1,993	1,205
	19,201	14,331	15,649	17,156	20,854	11,186

[1] Reported as shipments in 1945.

PRODUCERS AND PLANTS

The following companies shipped or used lead and zinc pigments and zinc salts of their own production in 1945:

White lead:	
The Eagle-Picher Co	Cincinnati, Ohio.
Euston Lead Co	Scranton, Pa.
W. P. Fuller & Co	South San Francisco, Calif.
International Smelting & Refining Co (electrolytic process).	East Chicago, Ind.
John T. Lewis & Bros. Co	Philadelphia, Pa.
The John R. MacGregor Lead Co	Chicago, Ill.
National Lead Co	Melrose, Calif.
Do. (2 plants)	Chicago, Ill.
Do	St. Louis, Mo.
Do	Perth Amboy, N. J.
Do	Brooklyn, N. Y.
The Sherwin-Williams Co	Chicago, Ill.
Basic lead sulfate, or sublimed lead:	
The Eagle-Picher Co	Galena, Kans.
National Lead Co	St. Louis, Mo.
Red lead, orange mineral, and litharge:	
American Cyanamid Co	Newark, N. J.
E. I. du Pont de Nemours & Co	East Chicago, Ind.
The Eagle-Picher Co	Galena, Kans.
Do	Joplin, Mo.
Do	Newark, N. J.
Do	Cincinnati, Ohio.
W. P. Fuller & Co	South San Francisco, Calif.
Hammond Lead Products, Inc	Hammond, Ind.
Morris P. Kirk & Son, Inc	Los Angeles, Calif.
John T. Lewis & Bros. Co	Philadelphia, Pa.
The John R. MacGregor Lead Co	Chicago, Ill.
Metals Refining Division of the Glidden Co	Hammond, Ind.
National Lead Co	Melrose, Calif.
Do	Atlanta, Ga.
Do	Chicago, Ill.
Do	St. Louis, Mo.
Do	Brooklyn, N. Y.
Do	Dallas, Tex.
Do	Charleston, W. Va.
The Sherwin-Williams Co	Chicago, Ill.

Zinc oxide and leaded zinc oxide:	
American Zinc Co. of Illinois	Hillsboro, Ill.
American Zinc Oxide Co	Columbus, Ohio.
The Eagle-Picher Co	Hillsboro, Ill.
Do	Galena, Kans.
Gulton Manufacturing Corp	Metuchen, N. J.
International Smelting and Refining Co	East Chicago, Ind.
Monsanto Chemical Co	St. Louis, Mo.
The New Jersey Zinc Co. of Pennsylvania	Freemansburg, Pa.
Do	Palmerton, Pa.
The Ozark Smelting & Mining Division of The Sherwin-Williams Co.	Coffeyville, Kans.
Rohm & Haas Co	Bristol, Pa.
St. Joseph Lead Co. of Pennsylvania	Josephtown, Pa.
Superior Zinc Corp	Bristol, Pa.
Lithopone:	
The Chemical & Pigment Co	Oakland, Calif.
Do	Collinsville, Ill.
Do	Baltimore, Md.
E. I. du Pont de Nemours & Co	Newport, Del.
The Eagle-Picher Co	Argo, Ill.
Mineral Point Zinc Division of The New Jersey Zinc Co.	Depue, Ill.
The New Jersey Zinc Co. of Pennsylvania	Palmerton, Pa.
The Ozark Smelting & Mining Division of The Sherwin-Williams Co.	Coffeyville, Kans.
Zinc sulfide:	
The New Jersey Zinc Co. of Pennsylvania	Palmerton, Pa.
Zinc salts:	
American Cyanamid Co	Bound Brook, N. J.
American Smelting & Refining Co	Selby, Calif.
Do	Alton, Ill.
Do	Omaha, Nebr.
Do	Perth Amboy, N. J.
Brooklyne Chemical Works, Inc	Baltimore, Md.
The Chemical & Pigment Co	Oakland, Calif.
Chemicals Incorporated	Chicago, Ill.
E. I. du Pont de Nemours & Co	Newport, Del.
Do	East Chicago, Ind.
Do	Cleveland, Ohio.
Do	Weirton, W. Va.
Jordan Company	Chicago, Ill.
Morris P. Kirk & Son, Inc	Los Angeles, Calif.
Charles Lennig & Co	Bridesburg, Pa.
Mallinckrodt Chemical Works	St. Louis, Mo.
Marathon Battery Co	Wausau, Wis.
Merrimac Division of Monsanto Chemical Co	Everett, Mass.
Niro Incorporated	Riverdale, N. J.
Royce Chemical Co	Carlton Hill, N. J.
The Ruby Chemical Co	Columbus, Ohio.
The Ozark Smelting & Mining Division of The Sherwin-Williams Co.	Coffeyville, Kans.
Southern Agricultural Chemical Corp	East Point, Ga.
Sullivan Mining Co	Kellogg, Idaho.
United States Steel Corp. (American Steel & Wire Co.)	Donora, Pa.
Virginia Smelting Co	West Norfolk, Va.
The Youngstown Sheet & Tube Co	East Chicago, Ind.

RAW MATERIALS USED IN MANUFACTURE OF LEAD AND ZINC PIGMENTS AND ZINC SALTS

Figures covering the raw materials used in making pigments and salts were not available when the report of this series for 1944 was prepared. Data for 1944 are given below, and those for 1945 will appear in the next annual issue of this volume.

Lead pigments and zinc pigments and salts are manufactured from a variety of materials, including ore, refined metal, and such secondary materials as scrap. In 1944, 93 percent of the lead in pigments was derived from pig lead and 7 percent from ore. Of the lead in ore used to make leaded zinc oxide, about 12 percent was from foreign sources. The proportion for zinc pigments in 1944 was 77 percent from ore and concentrates, 8.5 percent from slab zinc, and 14.5 percent from secondary materials; about 13 percent of the ore used was foreign.

Metal content of lead and zinc pigments produced by domestic manufacturers, 1943–44, by sources, in short tons

Source	1943		1944	
	Lead in pigments [1]	Zinc in pigments	Lead in pigments [1]	Zinc in pigments
Ore and concentrates:				
Domestic	14,356	97,332	17,684	121,395
Foreign	1,168	15,220	2,063	18,256
Metal	202,783	11,752	247,225	15,198
Secondary materials [2]	----------	19,809	----------	25,975
	218,307	144,113	266,972	180,824

[1] Includes also lead recovered in leaded zinc oxide.
[2] Zinc ashes, skimmings, drosses, and old metal.

The following tables give the source of the metal used in the manufacture of each pigment and salt. Pig lead is employed exclusively, either directly or indirectly, in the manufacture of white lead, litharge, red lead, and orange mineral and is used also in the manufacture of basic lead sulfate. The lead content of leaded zinc oxide made from basic lead sulfate, which in turn was made from pig lead, is credited to pig lead in the table. Zinc oxide is the only pigment in which considerable slab zinc is used. Ore is employed in the manufacture of zinc oxide, leaded zinc oxide, lithopone, zinc sulfide, zinc sulfate, and basic lead sulfate. A substantial proportion of the zinc in lithopone (slightly over one-half in 1944) and most of that in zinc chloride made in the United States are derived from secondary material. For a number of years before the United States entered World War II there had been a large increase in the quantity of secondary zinc used in the manufacture of zinc oxide. The scarcity of supplies of both metal and scrap caused the proportion of the total oxide made by the French process, which uses only metal and scrap, to drop sharply in 1942 and to continue low in 1943 and 1944, despite the fact that the percentage from metal and scrap rose in 1943 and continued upward in 1944. The production of zinc oxide from metal and scrap accounted for the following percentages in relation to total production: 41 percent in 1939, 16 percent in 1942, and 19 and 22 percent, respectively, in 1943 and 1944.

Lead content of lead and zinc pigments produced by domestic manufacturers, 1943–44, by sources, in short tons

Pigment	1943: Lead in pigments produced from— Ore: Domestic	1943: Ore: Foreign	1943: Pig lead	1943: Secondary material	1943: Total lead in pigments	1944: Lead in pigments produced from— Ore: Domestic	1944: Ore: Foreign	1944: Pig lead	1944: Secondary material	1944: Total lead in pigments
White lead	--------	--------	49,056	--------	49,056	--------	--------	61,143	--------	61,143
Red lead	--------	--------	48,499	--------	48,499	--------	--------	48,411	--------	48,411
Litharge	--------	--------	103,993	--------	103,993	--------	--------	136,353	--------	136,353
Orange mineral	--------	--------	3	--------	3	--------	--------	254	--------	254
Basic lead sulfate	4,165	--------	1,007	--------	5,172	2,709	--------	710	--------	3,419
Leaded zinc oxide	10,191	1,168	225	--------	11,584	14,975	2,063	354	--------	17,392
	14,356	1,168	202,783	--------	218,307	17,684	2,063	247,225	--------	266,972

Zinc content of zinc pigments and salts produced by domestic manufacturers, 1943–44, by sources, in short tons

Pigment or salt	1943: Zinc in pigments and salts produced from— Ore: Domestic	1943: Ore: Foreign	1943: Slab zinc	1943: Secondary material [1]	1943: Total zinc in pigments and salts	1944: Zinc in pigments and salts produced from— Ore: Domestic	1944: Ore: Foreign	1944: Slab zinc	1944: Secondary material [1]	1944: Total zinc in pigments and salts
Zinc oxide	70,069	10,314	11,752	7,164	99,299	85,075	10,186	15,198	11,376	121,835
Leaded zinc oxide	15,666	2,551	--------	449	18,666	26,893	5,141	--------	620	32,654
Lithopone	11,597	2,355	--------	12,196	26,148	9,427	2,929	--------	13,979	26,335
Zinc sulfide	(2)	(2)	--------	(2)	(2)	(2)	(2)	--------	--------	(2)
Zinc chloride	--------	--------	11	11,765	11,776	--------	--------	13	12,560	12,573
Zinc sulfate	1,734	414	32	2,837	5,017	1,607	998	36	2,410	5,051

[1] These figures are higher than those shown in the report on Secondary Metals—Nonferrous because they include zinc recovered from byproduct sludges, residues, etc., not classified as purchased scrap material.
[2] Bureau of Mines not at liberty to publish.

PRICES

The total and average values reported by producers for lead and zinc pigments and zinc salts are given in the tables in the first part of this report. For most of the products covered there was little change in the average prices received, as was to be expected in view of the fact that there were no changes in average quoted prices as given in the table that follows. Producers' values are reported on an f. o. b. plant basis, so that the small variations in these values can be explained by changes in the proportions at the several points of delivery. The ceiling prices established by the Office of Price Administration for the pigments and salts covered in this report, and likewise those for the metals lead and zinc, were unchanged throughout 1945 at the levels that prevailed in 1944.

Range of quotations on lead pigments and zinc pigments and salts at New York (or delivered in the East), 1942–45, in cents per pound

Product	1942	1943	1944	1945
Basic lead sulfate, or sublimed lead, less than carlots, barrels	7.00- 7.75	7.50- 7.75	7.50- 7.75	7.50- 7.75
White lead, or basic lead carbonate, dry, carlots, barrels	7.50- 8.25	8.25	8.25	8.25
Litharge, commercial, powdered, barrels	7.35- 9.00	8.00- 9.00	8.00- 9.00	8.00- 9.00
Red lead, dry, 95 percent or less, less than carlots, barrels	8.75-10.00	9.50-10.00	9.50-10.00	9.50-10.00
Orange mineral, American, small lots, barrels	11.25-12.50	12.00-12.50	12.00-12.50	12.00-12.50
Zinc oxide:				
American process, lead-free, bags, carlots	7.25	7.25	7.25	7.25
American process, 5 to 35 percent lead, barrels, carlots	7.00- 7.38	7.25- 7.38	7.25- 7.38	7.25- 7.38
French process, red seal, bags, carlots	8.50	8.50	8.50	8.50
French process, green seal, bags, carlots	9.00	9.00	9.00	9.00
French process, white seal, barrels, carlots	9.75	9.75	9.75	9.75
Lithopone, ordinary, small lots, bags	4.50	4.50	4.50	4.50
Zinc sulfide, less than carlots, bags, barrels	8.50- 8.75	8.50- 8.75	8.50- 8.75	8.50- 8.75
Zinc chloride, works:				
Solution, tanks	2.50	2.50	2.50	2.50
Fused, drums	5.00- 6.50	5.00- 6.50	5.00- 6.50	5.00- 6.50
Zinc sulfate, crystals, barrels	3.65- 4.60	3.85- 4.60	[1] 3.65- 4.60	[1] 3.65- 4.40

[1] Quotation was reduced to 3.65–4.40 cents per pound in the September 11, 1944, issue of the Oil, Paint and Drug Reporter, which added "works, freight allowed," to the description.

FOREIGN TRADE [4]

The total value of foreign trade in lead and zinc pigments remained relatively high during the war as compared with prewar levels. Imports cover small quantities only, and the export balance has exceeded

Value of foreign trade of the United States in lead and zinc pigments and salts, 1944–45

	1944		1945	
	Imports	Exports	Imports	Exports
Lead pigments:				
White lead	$4	$572,848	$54	$611,688
Red lead		411,620		385,563
Litharge	400	386,685	1,566	414,167
Orange mineral		3,079		920
Other lead pigments	5,558	12,424	5,997	8,831
	5,962	1,386,656	7,617	1,421,169
Zinc pigments:				
Zinc oxide	1,261	902,292	24	1,203,361
Lithopone		1,107,430	7	1,049,961
Zinc sulfide	281	7,195		25,399
	1,542	2,016,917	31	2,278,721
Lead and zinc salts:				
Lead arsenate		501,473		735,065
Other lead compounds		(1)	18	(1)
Zinc chloride		47,133		93,590
Zinc sulfate	28,678	83,566	16,775	62,119
Other zinc salts and compounds	(1)	46,587	(1)	119,747
	28,678	678,759	16,793	1,010,521
Grand total	36,182	4,082,332	24,441	4,710,411

[1] Data not available.
[4] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

$3,000,000 annually since 1941. Lithopone and zinc oxide exports both exceed any lead class. The total value of lead pigments exported rose 2 percent in 1945, and that of zinc pigments exported gained 13 percent. The value of exports of lead and zinc salts has been increasing and rose 49 percent in 1945. All of the foregoing foreign trade items are small compared with the totals for domestic trade.

Lead pigments and salts.—Imports of lead pigments and compounds continued to be insignificant in 1945. The principal items in the export classification are white lead, litharge, red lead, and lead arsenate; the last product ranked second in importance in 1945. All of the principal items except red lead gained in 1945, and without exception all were considerably larger in 1945 than in 1939.

Lead pigments and salts imported for consumption in the United States, 1941–45

Year	Short tons				Total value
	Basic carbonate white lead	Red lead	Litharge	Lead compounds	
1941	2	3	----------	17	[1] $15,367
1942	----------	2	2	11	[1] 5,841
1943	----------	4	1	----------	[1] 3,349
1944	(2)	----------	1	----------	[1] 5,962
1945	1	----------	8	(2)	[1] 7,635

[1] Includes also suboxide of lead, n. s. p. f., as follows—1941: $11,694 (65,268 pounds); 1942: $3,221 (13,228 pounds); 1943: $2,283 (6,614 pounds); 1944: $5,558 (19,842 pounds); 1945: $5,997 (19,842 pounds).
[2] Less than 1 ton.

Lead pigments and salts exported from the United States, 1941–45

Year	Short tons						Total value
	White lead	Red lead	Litharge	Orange mineral	Sublimed lead	Lead arsenate	
1941	2,901	2,966	2,892	(1)	(1)	4,797	$2,100,335
1942	2,249	1,391	1,999	7	95	296	1,030,472
1943	4,692	1,535	1,610	7	71	1,527	1,814,612
1944	3,052	2,117	2,391	13	82	2,133	1,888,129
1945	4,079	1,922	2,512	3	53	3,170	2,156,234

[1] Not compiled on an annual basis before 1942.

Zinc pigments and salts.—As in earlier years, zinc sulfate was the principal product in the import group, but only 421 tons of this salt entered the United States in 1945. Lithopone and zinc oxide rank first and second among the export products covered by the above heading. Exports of lithopone in 1945 were relatively unchanged from the reduced shipments for 1944, whereas those of zinc oxide rose 29 percent in 1945 and were the largest since 1941. The quantities for the two products mentioned amounted to nearly 9 and 6 percent, respectively, of total domestic shipments. On a tonnage basis, the principal zinc salts exported are zinc chloride and zinc sulfate; the former doubled in 1945, whereas the latter declined 39 percent. Zinc salts were shown separately on an annual basis in 1942 for the first time.

Zinc pigments and salts imported for consumption in the United States, 1941–45

Year	Short tons: Zinc oxide: Dry	Short tons: Zinc oxide: In oil	Short tons: Lithopone	Short tons: Zinc sulfide	Short tons: Zinc sulfate	Total value
1941	122	11	(1)	1	162	$29,835
1942	13	1		1	362	26,390
1943	10	11			546	34,033
1944	(1)	5		(1)	542	30,220
1945	(1)		(1)		421	16,806

[1] Less than 1 ton.

Zinc pigments and salts [1] exported from the United States, 1941–45

Year	Short tons: Zinc oxide	Short tons: Lithopone	Total value	Year	Short tons: Zinc oxide	Short tons: Lithopone	Total value
1941	8,264	21,527	$3,525,386	1944	5,511	11,551	[2] $2,194,203
1942	6,013	17,036	[2] 2,913,595	1945	7,102	11,576	[2] 2,554,177
1943	6,019	17,320	[2] 2,898,253				

[1] Zinc salts not separately recorded on an annual basis before 1942.
[2] Includes also—1942: Zinc sulfide $6,328 (37,691 pounds); zinc chloride, $42,674 (648,343 pounds); zinc sulfate, $53,624 (1,025,554 pounds); other zinc salts and compounds, $76,023 (519,458 pounds). 1943: Zinc sulfide, $29,523 (78,387 pounds); zinc chloride, $57,390 (751,861 pounds); zinc sulfate, $81,750 (1,830,508 pounds); other zinc salts and compounds, $22,087 (139,940 pounds). 1944: Zinc sulfide, $7,195 (40,223 pounds); zinc chloride, $47,133 (711,953); zinc sulfate, $83,566 (2,029,801 pounds); other zinc salts and compounds, $46,587 (167,474 pounds). 1945: Zinc sulfide, $25,399 (173,475 pounds); zinc chloride, $93,590 (1,499,755 pounds); zinc sulfate, $62,199 (1,243,826 pounds); other zinc salts and compounds, $119,747 (750,108 pounds).

THE MINERAL INDUSTRY OF ALASKA

(MINE REPORT)

By H. Foster Bain[1]

SUMMARY OUTLINE

GENERAL CONDITIONS

The year 1945 was another disappointing one so far as it concerned the mining industry of Alaska, even though the total value of mineral production increased 48 percent, from $6,903,000 in 1944 to $10,210,000[2] in 1945. The release of men and equipment from war work following VJ-day came too late in the season to have much influence on the mineral output. The ending of the war found most of the gold mines closed, stripped of tools and equipment, and with their former working forces widely scattered. In the fall it is customary for most of the men to come in from the creeks to spend the winter in town or "outside"; and between the end of the fighting in August and this annual exodus, there was not enough time to do much. The tie-up of transportation that came not long after as a result of picketing the docks at Seattle and a longshoreman strike at various Pacific coast ports prolonged the difficulty. Even when companies were able to buy new equipment, it was difficult to get it into the country. Where surplus Army tools and supplies were released, they were often in the wrong part of the Territory for immediate use in mining; and, moreover, there were complaints of slowness in the release of these materials. The year ended therefore with much less work than usual done on freighting in supplies preparatory to the 1946 season.

The dredging companies were in somewhat better position to resume work than others, since the dredges had not been taken over for war work; and, the bulk of their supplies being special, their inventories were not so depleted. A few operations had been allowed to continue uninterrupted for particular reasons, such as those of the Goodnews Bay Mining Co., which produce platinum, a highly strategic mineral. The U. S. Smelting, Refining & Mining Co. had been able to keep one dredge and a dragline operating on Cripple Creek near Fairbanks (later transferring the crew to No. 8 on Goldstream), and its powerhouse had operated steadily to supply current to various

[1] This chapter has been prepared with the especial cooperation of Robert S. Sanford, district engineer of the Bureau of Mines, and B. D. Stewart, Territorial Commissioner of Mines, both of Juneau, Alaska.
[2] For detailed table on Alaskan mineral production, see chapter of this volume, Statistical Summary of Mineral Production.

war enterprises. Minor repairs had been kept up; and, as promptly as labor became available, thawing at Chatanika was resumed with six drills, and a general overhaul of all dredges was begun in preparation for 1946. At Nome, the bunkhouses and other property taken over earlier by the Army were repurchased and redistributed in preparation for active operations, ditches were cleaned, and other preparatory work was accomplished. Little mining, however, could be done anywhere because of labor shortage which, in Alaska as elsewhere, was unexpected and greatly hampered any operations.

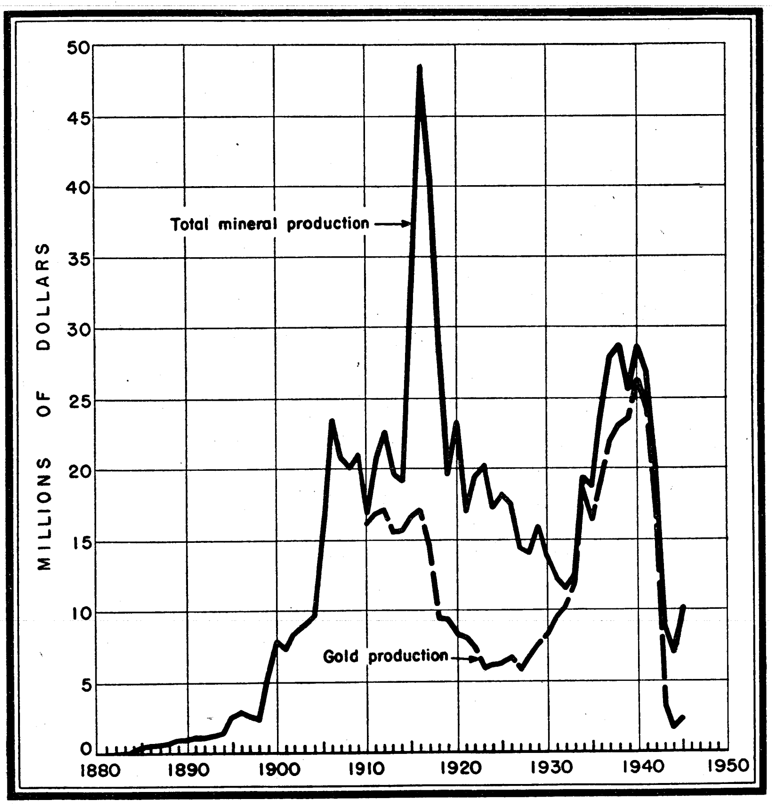

FIGURE 1.—Trends in value of total mineral production (1880–1945) and gold production (1910–45) in Alaska. In the years prior to 1910, mineral production was almost entirely gold. From 1911 to 1931 copper production accounted for most of the value of minerals other than gold.

In all, 13 dredges and 16 draglines operated some portion of the year in 1945. Production was credited to some others because outputs of earlier years were shipped in 1945. Lists of the dredge and dragline operations that shipped gold follow. In addition to those listed, 172 other placer properties were active some portion of the year. Of the lode mines, production was reported from 18 properties.

Dredges that shipped gold in 1945

Operator	District
Arctic Circle Exploration Co	Fairhaven
Council Dredging Co	Council-Bluff
Dry Creek Dredging Co	Fairhaven
Gold Placers, Inc	Circle
Goodnews Bay Mining Co	Goodnews Bay
Lee Bros	Nome
New York Alaska Gold Dredging Co. (2 dredges)	Tuluksak-Aniak
Nome Creek Mining Co	Tolovana
North American Gold Dredging Co	Iditarod
John Peterson and Victor Isaacson	Innoko
U. S. Smelting, Refining & Mining Co. (2 dredges)	Fairbanks
Wade Creek Dredging Co. & Mining Co	Fortymile

Draglines that shipped gold in 1945

Marvel Creek Mining Co. operated a dragline on Marvel Creek, in the Tuluksak area.
Arctic Circle Exploration Co. operated a dragline in conjunction with a dredge on Candle Creek.
Fisher & Fisher operated a dragline-hydraulic-bulldozer lay-out on Grant Creek, in Fort Gibbon Precinct.
Goodnews Bay Mining Co. operated a dragline in conjunction with its platinum dredge on Salmon River.
Joe Degnan operated a dragline-bulldozer lay-out intermittently on Little Creek, in the Takotna district.
Uotilla & Hard operated a dragline-bulldozer-hydraulic lay-out on Ophir Creek.
South Fork Mining Co. operated a dragline-bulldozer-hydraulic lay-out on the Gold Bench claim, in the Koyukuk district.
Awe Mining Co. operated a dragline-bulldozer lay-out on Chicken Creek, in the Flat district.
Uotilla & Ogriz operated a dragline-bulldozer lay-out on Slate Creek, in the Flat district.
Amy Creek Mining Co. operated a dragline-bulldozer-hydraulic lay-out on Amy Creek, in the Tolovana district.
Herbert Engstrom operated a dragline on Basin Creek, in the Nome district.
First Chance Mining Co. operated a dragline at the First Chance Mine, in the Fairbanks district.
Wolf Creek Mining Co. operated a dragline on Wolf Creek, in the Fairbanks district.
Patrick Savage operated a dragline on Flat Creek, in the Iditarod district.
Sid Paulson operated a dragline on the Colorado placer, in the Innoko district.
Nels J. Vibe operated a dragline on Little Creek, in the Innoko district.

The most serious factor hindering resumption of work was the diversion of labor from mining and the complete upset in the wage scale throughout the Territory. In the haste to get war construction completed despite shortage of manpower, not only had base rates of pay been raised, but also overtime pay had greatly increased the actual take-home wage. Still more disturbing was the general reclassification and upgrading of workmen in an effort to hold them on the job and avoid technical violation of wage regulations. The result was that actual rates of pay got all out of line with metal prices, so much so that until readjustments are made it will be impossible to operate many of the mines with any hope whatever of profit or even, in many instances, of avoiding loss. The great Alaska-Juneau, the largest industrial unit in Alaska, remained idle, with the plant in the hands of caretakers. This exceptional rise in wages hits mining hard because the labor cost is, in most mines, much the largest element in total cost. Coupled with this is the fixed price for gold, and gold mining normally accounts for 90 percent of the value of the annual mineral output of the Territory. Until a better balance between cost and price is re-established by one means or another, recovery of gold mining, and probably all mining in Alaska, is bound to lag. The time has been too short since fighting stopped to permit these adjustments, and such operations as are now under way in the Territory are being conducted very largely with an eye to the future rather than to immediate profit. The U. S. Smelting, Refining & Mining Co. has, for example, proved a considerable acreage of placer ground along Hog River in Northwestern Alaska but will not attempt for the present to equip for operation. Options have been taken on various smaller properties by local and outside companies; but, aside from examination, prospecting, and a limited amount of development, little is being done.

One feature of the present situation that may prove to have long-time significance is the interest being shown in the Territory by Canadian companies that have taken options on properties in several districts. Mining in Canada has been very profitable in recent years, and Canadian companies have considerable funds for reinvestment. They show a strong disposition to put their money into finding more mines, whereas the older American companies with heavy investments in reduction and manufacturing plants tend to be more cautious.

Another new current in mining in Alaska is the entrance into the field of some of the construction companies that came into the Territory to build airports and other war facilities. They are well-financed, are experienced in moving dirt and other operations common in mining, and are controlled by men accustomed to taking risks. If they win early success it may well have an important influence on the future of mining in Alaska. The C. F. Lytle Co. and the Green Construction Co. are prospecting the St. Amand ground near Fairbanks, and others have shown interest. The war advertised Alaska and introduced it to numerous individuals and groups to whom it was, until then, an unknown area, and this seems certain to affect its mining industry.

Although 1945 was a good season for mining, in that there was plenty of water, the industrial factors mentioned operated so strongly that gold production increased only moderately (38 percent). Fortunately, that is not the whole story. The wide search for strategic minerals by the Government and private individuals, which characterized the war effort, has left its mark. Among other material of future value is the complete set of maps of the Territory compiled by the Army Air Forces by trimetrogon photography, supplementing the earlier work of the Geological Survey. This work is still under way, and a map on the scale of 1:500,000 will soon be completed.

Another development that promises to result in a permanent industry has grown out of the work on mercury deposits. The two leading mines are the Red Devil and the Decoursey; a new mine, the Red Top, near Lake Alaknagik down in the Bristol Bay region, has become a producer.

Development was continued on the Cliffside lode of the Red Mountain Chromite, Inc., property, on Windy River, where a 180-foot adit was driven and is believed to have penetrated the Star Four ore body. No chromite, however, was mined or shipped, and Metals Reserve stopped buying it and other war minerals. Interest in antimony, tungsten, zinc, and other miscellaneous war minerals has accordingly died down, although some revival in copper mining is promised. It is announced that the Alaska Gold & Metals Co. will attempt to raise enough money to reopen the old Rush and Brown mine and to do additional drilling on the Salt Chuck property, both on Prince of Wales Island. A Bureau of Mines engineer sampled the old Khayyam copper mine on the same island and found some 90,000 tons of ore of the usual small copper-gold-silver value in pyrite.

Another event of possible future importance was the preliminary sampling by the Bureau of Mines of a deposit of mixed sulfide ores on Sedanka Island near Dutch Harbor. The Aleutian Islands have received little attention from mining men despite their ready accessibility by sea and now by air. The Sedanka deposit is about 25 miles from Dutch Harbor and near a deep, sheltered, local harbor. The lode has been explored and sampled for 240 feet of length and is dominantly a lead-zinc ore body, with minor quantities of copper, gold, and silver. The deposit evidently warrants serious consideration.

Coal mining slumped with the end of the war demand. The Army Coal Procurement Branch has withdrawn after making a settlement with W. E. Dunkle at the Colorado mine and with the company operating the Buffalo mine in the Matanuska field. At the Buffalo, underground equipment was removed and the mine allowed to fill with water. Both the Eska and Jonesville mines continued in operation, but against many difficulties and at high cost. At Healy, the Suntrana mine of the Healy River Coal Corp. continued in operation, and the Diamond Coal Co. began shipments near the end of the year. This company's mine is about 4 miles west of the railroad, and the coal is trucked to a loading bunker at Healy station. The Meade River mine, 65 miles southwest of Barrow, continued in operation all winter and delivered 700 tons of coal to Barrow, relieving the fuel situation at that point.

Also of possible great significance for the future is the considerable growth of interest in the nonmetallic minerals. In central Alaska a special survey is being planned along the railroad, and in southeastern Alaska preparations for shipments of limestone are now being made at two points. The Commissioner of Mines completed a survey of the limestones of that region, and the Federal Bureau of Mines also did some sampling there. Both organizations report large quantities of high-grade rock well-situated for quarry operations and easily accessible from the sea. Before the war the Superior Portland Cement Co., of Seattle, drew its supply from View Cove on Dall Island. Loss of its steamer, taken over by the Navy for wartime service, forced the company to stop this movement. Men have now been sent in to rehabilitate the camp and quarry in preparation for resuming shipments.

A new enterprise is being established by the Aluminum Co. of America at Edna Bay, on Kosciusko Island. After a study of the whole region, this point was selected by the company for establishing a limestone quarry. The camp of the Forest Service, operated as part of the Alaska spruce logging program, has been purchased and is being repaired and made ready to serve as the shipping point for the limestone. The latter is to be used in the lime roasting of certain bauxite deposits in Oregon.

In the northwest, the Arctic Circle Exploration Co. not only operated for gold but mined for both asbestos and jade along Kobuk River and its tributaries, where the Federal Bureau of Mines also continued its prospecting. Production for the year amounted to 10 tons of tremolite and 1 ton of chrysotile asbestos and 13 tons of nephrite jade. An area 45 miles long, in which these minerals are found, is still inadequately prospected. At the high prices at which asbestos of this grade and jade are sold, it seems probable that a small permanent industry may be built up here.

Another notable event of the year was the drilling of the first well in search of oil in Petroleum Reserve No. 4, in northern Alaska. This well was drilled by a Seabee crew to a depth of 1,900 feet and is reported to have passed through five "oil sands which had been drained" without getting to the bottom of the presumed productive formation. The Navy has now contracted with a private company to continue the exploration in 1946 and to make extensive geophysical surveys. A survey was also made for a pipeline to Fairbanks, and studies were made of the flowability of the oil expected to be found. No progress was made in exploration of the possible petroleum fields along the southern coast, although leases have been granted at Iniskin Bay.

One of the residual benefits of the war work in Alaska is a considerable extension of the road system. The Alaska Highway has been built from Fairbanks to Haines with a connection east to Whitehorse in Canada, and south by way of the Tok, Richardson, and Glenn Highways into the Copper River Basin, the Matanuska coalfield, Valdez, and Anchorage. A caterpillar trail has been opened north from the Alaska Highway, at Tancross, to the Fortymile district, and will, no doubt, be made over into a regular highway. It is already serving as a route of entry to various mining districts along the Yukon for supplies and machinery.

METAL PRODUCTION

The following tables show the mine production of gold, silver, copper, and lead in Alaska in 1941–45, and 1880–1945, in terms of recovered metals; the output of gold and silver in 1945, by types of operation; and the output of gold, silver, copper, and lead, from amalgamation and cyanidation mills (with or without concentration equipment) in 1945, by regions.

Much of the production shown in the tables following was actually mined in the years 1942–44 but apparently was not then shipped because of war conditions. The actual quantity by years is not known. Shipments of 6,120 ounces of gold and 896 of silver received at the Seattle Assay Office in February 1946 are here credited as 1945 production.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Gold and silver.—Placer and lode mines in 1945 yielded (in terms of recoverable metals) 68,117 ounces of gold valued at $2,384,095, compared with 49,296 ounces valued at $1,725,360 in 1944—an increase of 38 percent; and 9,983 ounces of silver valued at $7,099, compared with 13,362 ounces valued at $9,502 in 1944—a decline of 25 percent. Although gold production increased 38 percent, this improvement would appear to be no more than moderate in degree when the scale of prewar production (755,970 ounces, with a value of $26,458,950, in 1940) is considered. The ratio of silver production to gold production in 1945 was 1 : 6.82, compared with 1 : 3.69 in 1944—reflecting the decreased proportion of production from lode mines in 1945.

The Yukon River Basin region, of the eight mining regions, contributed the largest output of gold—49 percent of the total; the other regions, in order of greatest production, were Seward Peninsula, Kuskokwim, Southeastern Alaska, Cook Inlet-Susitna, Kenai Peninsula, Copper River, and Northwestern Alaska. The largest production of silver in 1945 also came from the Yukon Basin region, with Seward Peninsula and Southeastern Alaska in second and third place, respectively.

Mine production of gold, silver, copper, and lead in Alaska, 1941–45, and total, 1880–1945, in terms of recovered metals

Year	Gold (lode and placer)		Silver (lode and placer)	
	Fine ounces	Value	Fine ounces	Value
1941	695,467	$24,341,345	191,522	$136,193
1942	487,621	17,066,735	119,704	85,123
1943	99,583	3,485,405	42,788	30,427
1944	49,296	1,725,360	13,362	9,502
1945	68,117	2,384,095	9,983	7,099
1880–1945	25,856,647	617,997,247	19,748,505	14,047,822

Mine production of gold, silver, copper, and lead in Alaska, 1941–45, and total, 1880–1945, in terms of recovered metals—Continued

Year	Copper		Lead		Total value
	Pounds	Value	Pounds	Value	
1941	144,000	$16,992	1,324,000	$75,468	$24,569,998
1942	44,000	5,324	830,000	55,610	17,212,792
1943	54,000	7,020	400,000	30,000	3,552,852
1944	4,000	540	88,000	7,040	1,742,442
1945	10,000	1,350	22,000	1,892	2,394,436
1880–1945	[1] 685,864	226,563,216	[1] 24,811	2,749,563	861,357,848

[1] Short tons.

Mine production of gold and silver in Alaska in 1945, by types of operation, in terms of recovered metals

Type of operation	Mines producing	Material treated	Gold			Silver			Total value
			Fine ounces	Percent of total		Fine ounces	Percent of total		
				1945	1944		1945	1944	
Lode mines	18	[1] 6,512	10,409	15	32	2,897	29	69	$366,375
Floating connected-bucket dredges	[2] 12	[3] 4,708,675	34,885	51	53	3,933	39	18	1,223,772
Placer (dragline and dry-land dredges, hydraulic, drift mining, sluicing, etc.)	[4] 188	([5])	22,823	34	15	3,153	32	13	801,047
	218		68,117	100		9,983	100		2,391,194
Total, 1944	207		49,296		100	13,362		100	1,734,862

[1] Short tons of ore.
[2] 14 dredges; 2 mines operated 2 dredges each.
[3] Cubic yards of gravel.
[4] Includes all other types and sizes of placer operations.
[5] Figures not available.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Alaska in 1945, by regions, in terms of recovered metals

Region	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)
Cook Inlet-Susitna	1,979	1,673	97	34	173	17		
Kenai Peninsula	450	214	66	1	14	7		
Southeastern Alaska	1,645	3,107	618	69	1,005	1,175		22,000
Yukon River Basin	2,432	4,220	879					
	6,506	9,214	1,660	104	1,192	1,199		22,000
Total, 1944	381,574	12,601	2,601	208	3,084	6,569	4,000	88,000

Bullion of Alaska origin deposited at United States Assay Office, Seattle, Wash., during year ended Dec. 31, 1945, in fine ounces

Region	Gold	Silver	Region	Gold	Silver
Cook Inlet-Susitna	1,851	124	Seward Peninsula	17,570	2,392
Copper River	11	1	Southeastern Alaska	3,104	616
Kenai Peninsula	214	66	Yukon River Basin	26,708	3,587
Kuskokwim	8,736	747			
Northwestern Alaska	22	5		58,216	7,538

Placer mines, principally in the Yukon River Basin and Seward Peninsula regions, produced 85 percent of the gold and 71 percent of the silver from Alaska in 1945. Floating connected-bucket dredges, of which 7 were in the Yukon River Basin region, 4 in the Seward Peninsula, and 3 in the Kuskokwim, produced 51 percent of the total gold output of the Territory in 1945 and 39 percent of the silver; 9 dredges were active in 1944. The Arctic Circle Exploration Co. was the largest producer of gold and silver from bucket-dredging operations in 1945; the company operated 1 dredge on Candle Creek in the Seward Peninsula region during part of the 1945 season and handled 176,000 cubic yards of gold-bearing gravel—the remainder of the open season was employed in preparation for full-scale operations during 1946. The United States Smelting, Refining & Mining Co. was the second most productive bucket-dredging operation in Alaska during 1945. Dredging was carried on a total of 156 days between May 21 and November 16, and a total of 1,041,227 cubic yards of material was washed. In addition, the company removed about 500,000 cubic yards of overburden by hydraulicking and using a dragline. The New York Alaska Gold Dredging Co. operated its dredge on the Tuluksak River in the Kuskokwim region from May 10 until November 13. Gold Placers, Inc., operated its 4-cubic foot Diesel-powered dredge on Coal Creek in the Yukon River Basin region from June 18 until October 17. During the period of operations, 221,500 cubic yards of gravel were washed which yielded about 3,500 ounces of fine gold. Other large dredging operations in Alaska in 1945 were the North American Dredging Co. at Flat, the Council Dredging Co. at Council, and the Lee Bros. Dredging Co. at Solomon. The Goodnews Bay Mining Co. operated its Yuba electrically powered dredge on Salmon River in the Kuskokwim region from April 24 to November 15, 1945, and handled 1,125,850 cubic yards of gravel; some gold was recovered although the principal yield was platinum. A total of 16 dragline dredges were active in Alaska in 1945 and contributed 16 percent of the total gold recovered in the Territory during the year. One of the largest producers in Alaska in 1945 using a dragline dredge was the South Fork Mining Co., operating on the Gold Bench claim in the Koyukuk district. The company washed about 70,000 cubic yards of gold-bearing gravel during an operating period of 90 days and recovered 1,692 fine ounces of gold and 246 ounces of silver. Other producers included the Uotila & Hard operation on Ophir Creek in the Yukon River Basin region, the Marvel Creek Mining Co. on Marvel Creek in the Kuskokwim region, and the Arctic Circle Exploration Co. in the Seward Peninsula region. In addition, 172 mines were being worked by other methods of placer mining in 1945.

The Cleary Hill Mines Co. operated its mine on Cleary Creek in the Fairbanks district during 1945 and was the largest producer of lode gold in Alaska. The Alaska Juneau Gold Mining Co. closed its Alaska Juneau mine on April 9, 1944, for an indefinite period. During 1945 the mine remained closed; however, the company shipped gold bullion to the Seattle Assay Office and lead concentrates to the Selby, Calif., smelter from plant absorption clean-ups. The Alaska Pacific Consolidated Mining Co. employed 20 men in its mining operation at its Independence mine in the Willow Creek district north of Wasilla. The mine and 70-ton Independence amalgamation-flotation-concentration mill were worked from January 1 until August 8, when all operations ceased. During the period of activity, 1,747 tons of gold ore were treated, making gold bullion, which was shipped to the Seattle Assay Office, and gold concentrates, which were shipped to the Tacoma, Wash., smelter.

Chromite.—The mine of the Chrome Queen Mining Co., in the Kenai Peninsula region, was closed throughout 1945, operations having been indefinitely suspended in August 1944 on completion of the company's contract with the Metals Reserve Company. A publication [3] describing the exploration of the Red Mountain chromite deposits on the Kenai Peninsula was issued recently by the Bureau of Mines.

Copper.—Copper output in 1945 came entirely from the Copper River region, where production totaled 10,000 pounds valued at $1,350, compared with 4,000 pounds valued at $540 in 1944—an increase of 150 percent in quantity. The average weighted yearly price per pound for copper in 1945 was $0.135, as in 1944.

Lead.—The Southeastern Alaska region was the sole source of lead production in 1945. Output totaled 22,000 pounds valued at $1,892, compared with 88,000 pounds valued at $7,040 in 1944—a decrease of 75 percent in quantity. The average weighted yearly price per pound for lead advanced from $0.080 in 1944 to $0.086 in 1945.

Platinum metals.—Placer deposits in the Goodnews Bay district in Southeastern Alaska yielded 26,505 ounces of platinum in 1945, compared with 33,616 ounces in 1944. Production was won by a large modern dredge and well-mechanized draglines. A small quantity of gold was recovered as a byproduct.

Mercury.—Output in most mercury-producing areas in the United States decreased in 1945, whereas in Alaska production reached a new peak. The two principal producers were the Red Devil (New Idria-Alaska) and the Decoursey Mountain mines. Operations at both properties were closed at the end of the year because of the winter season. The Red Devil ore was treated in a 3- by 40-foot Gould rotary furnace; that at Decoursey Mountain was reduced in a two-tube D-type retort. Most of the ore treated at the Red Devil mine was from the new 100-foot level.

Tin.—In 1945, for the second consecutive year, no tin production was reported for Alaska. Some concentrates that had been produced prior to 1944 and acquired by the Reconstruction Finance Corporation were

[3] Rutledge, F. A., Exploration of Red Mountain Chromite Deposits, Kenai Peninsula, Alaska: Bureau of Mines Rept. of Investigations 3885, 1946, 26 pp.

shipped out of the Territory in 1945 to the Texas City, Tex., tin smelter. A lode deposit on Seward Peninsula, which is reported to have greater potentialities than any other known domestic source of tin, was tested by diamond drilling under the exploratory program of the Bureau of Mines.

Tungsten.—No tungsten concentrates were produced in Alaska in 1945. Milling of tungsten ore at the Riverside mine near Hyder was suspended throughout the year owing to economic conditions and insufficient labor; 1,300 tons of ore, however, were mined at the property.

Other metals.—There was no recorded production of antimony, iron ore, manganese, molybdenum, vanadium, or zinc in Alaska in 1945.

NONMETALLIC PRODUCTION

As in 1944, and for the second time in the history of Alaskan mining, the value of the yield of nonmetals in 1945 exceeded that of the metals, amounting to $6,484,000 as compared with $3,732,000 for the metals.

Coal.—Coal output in 1945 totaled 300,000 tons valued at $1,905,000 as compared with 348,375 tons and $2,239,684 in 1944—a decrease of 14 percent in quantity and 15 percent in value. Although coal mining slumped with the end of the war, an increase in demand for the fuel developed with the close of the year.

Sand and gravel.—Production of sand and gravel in Alaska in 1945 was considerable, but figures cannot be released at this time.

Stone.—Production of stone in Alaska in 1945 was also considerable, but figures likewise cannot be released at this time.

Asbestos.—Ten tons of tremolite asbestos and 1 ton of longslip-fiber chrysotile, as already mentioned, were produced by the Arctic Exploration Co. from deposits in the Dahl Creek area, Kobuk River district.

Jade.—Thirteen tons of jade, some of it of gem quality and comparable with the better New Zealand nephrite, was produced by the Arctic Exploration Co., as already mentioned, from an occurrence along the Kobuk River.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN ARIZONA

MINE REPORT)

By C. E. Needham and Paul Luff

SUMMARY OUTLINE

SUMMARY

Despite a decrease of 20 percent in the production of copper in Arizona in 1945 compared with 1944, the State remained the largest producer of copper in the United States. The drop in the output of copper ore not only resulted in a marked decline in production of copper but also of gold and silver, as copper ore is the principal source of gold and silver in Arizona. The production of both lead and zinc, however, increased considerably. Production in 1945 (in terms of recoverable metals) was 77,223 fine ounces of gold, 3,558,216 fine ounces of silver, 574,406,000 pounds of copper, 45,734,000 pounds of lead, and 80,452,000 pounds of zinc, indicating decreases from 1944 of 31 percent in gold, 19 percent in silver, and 20 percent in copper; lead increased 37 percent and zinc 38 percent. The total value of the five metals was $95,963,006 in 1945 compared with $113,094,806 in 1944. The total value of the gold was $2,702,805—3 percent of the State total value; silver, $2,530,287—nearly 3 percent; copper, $77,544,810—81 percent; lead, $3,933,124—4 percent; and zinc, $9,251,980—nearly 10 percent. The value of the metals recovered from copper ore was $80,461,465 in 1945 ($101,163,271 in 1944), or 84 percent of the State total. About 93 percent of the State gold production and 79 percent of the silver in 1945 came from seven districts—Ajo, Big Bug, Copper Mountain (Morenci), Globe-Miami, Pioneer (Superior), Verde (Jerome), and Warren (Bisbee); 98 percent of the copper came from eight districts—Ajo, Copper Mountain (Morenci), Eureka (Bagdad), Globe-Miami, Mineral Creek (Ray), Pioneer (Superior), Verde (Jerome), and Warren (Bisbee); nearly 90 percent of the lead came from six districts—Big Bug, Harshaw, Old Hat, Pima, Wallapai (Chloride), and Warren (Bisbee); and nearly 95 percent of the zinc came from nine districts—Big Bug, Cochise (Dragoon), Harshaw, Old Hat, Patagonia, Pima, Pioneer (Superior), Wallapai (Chloride), and Warren (Bisbee).

Since inauguration in February 1942 of the Government premium price plan, the base price of copper, lead, and zinc has remained unchanged; copper has been $0.12 a pound, lead $0.065 (New York), and zinc $0.0825. The basic Government policy of premium payments for overquota production remained in force throughout 1945.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Arizona, 1941–45, and total, 1860–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	805	184	25,491,794	315,392	$11,038,720	7,498,260	$5,332,096
1942	515	163	33,920,731	253,651	8,877,785	7,064,467	5,023,621
1943	274	19	36,630,788	171,810	6,013,350	5,713,889	4,063,210
1944	226	17	35,900,641	112,162	3,925,670	4,394,039	3,124,650
1945	202	18	31,266,904	77,223	2,702,805	3,558,216	2,530,287
1860–1945			(1)	10,789,135	265,114,880	289,418,649	214,623,537

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	652,634,000	$77,010,812	31,276,000	$1,782,732	32,986,000	$2,473,950	$97,638,310
1942	786,774,000	95,199,654	29,544,000	1,979,448	37,044,000	3,445,092	114,525,600
1943	806,362,000	104,827,060	27,454,000	2,059,050	39,354,000	4,250,232	121,212,902
1944	716,606,000	96,741,810	33,414,000	2,673,120	58,154,000	6,629,556	113,094,806
1945	574,406,000	77,544,810	45,734,000	3,933,124	80,452,000	9,251,980	95,963,006
1860–1945	[2] 10,888,869	3,215,568,550	[2] 350,127	43,144,392	[2] 233,805	42,719,661	3,781,171,020

[1] Figures not available.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1945, by months, in terms of recovered metals

	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	6,970	342,786	52,068,000	3,586,000	6,222,000
February	6,390	308,621	47,144,000	3,510,000	6,082,000
March	7,762	353,720	51,618,000	3,334,000	6,406,000
April	7,313	328,970	51,066,000	4,164,000	6,814,000
May	7,683	346,420	52,538,000	3,854,000	6,782,000
June	6,807	312,720	48,444,000	4,192,000	7,378,000
July	5,639	253,920	43,854,000	3,848,000	6,920,000
August	5,942	266,190	44,534,000	3,698,000	6,920,000
September	5,597	255,720	44,770,000	3,936,000	6,436,000
October	5,741	257,720	45,994,000	3,664,000	6,912,000
November	5,839	275,720	46,186,000	4,074,000	6,880,000
December	5,540	255,709	46,190,000	3,874,000	6,700,000
Total	77,223	3,558,216	574,406,000	45,734,000	80,452,000

Gold and silver produced at placer mines in Arizona, 1941–45, in fine ounces, in terms of recovered metals

Year	Sluicing [1]		Drift mining		Dredges				Total	
					Dry-land [2]		Dragline floating [2]			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1941	976	125	77	5	824	717	10,054	1,358	11,931	2,205
1942	885	176			35	5	1,916	217	2,836	398
1943	315	14	4						319	14
1944	242	90							242	90
1945	535	45	5						540	45

[1] Includes placer sands treated by dry concentration plants.
[2] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

Gold.—Although the War Production Board gold-mine closing order (L–208), issued October 8, 1942, was rescinded July 1, 1945, no revival at gold mines in Arizona was noticeable during the year. In 1945 more than 80 percent of the State gold output was recovered from copper ore, 14 percent from zinc-lead ore, 3 percent from siliceous ores, and most of the remainder from lead ore and zinc-copper ore and from placers. Gold from siliceous ores declined 78 percent and that from copper ore more than 31 percent, but that from zinc-lead ore increased 49 percent. Gold from placers increased from 242 ounces to 540. The New Cornelia mine of the Phelps Dodge Corp., in Pima County, was the leading gold producer in Arizona; it was followed by the Copper Queen (Bisbee) branch of the Phelps Dodge Corp., in Cochise County, the United Verde and Iron King mines in Yavapai County, the Morenci branch of the Phelps Dodge Corp. in Greenlee County, the Magma mine in Pinal County, and the Denn mine in Cochise County; these seven properties produced 88 percent of the State total gold.

Silver.—Most of the silver produced in Arizona is a byproduct of copper ore and zinc-lead ore, and in 1945 these two classes of ore yielded 91 percent of the State total (copper ore yielded 59 percent and zinc-lead ore 32 percent); the remainder came principally from siliceous ores, zinc-copper ore, lead ore, and zinc-lead-copper ore. Silver from copper ore declined 992,865 ounces or 32 percent, that from siliceous ores 45,044 ounces or 23 percent, and that from lead ore, zinc-copper ore, and zinc-lead-copper ore 134,215 ounces or 45 percent; however, the output of silver from zinc-lead ore increased 330,264 ounces or 42 percent. The Phelps Dodge Corp. continued to be the chief silver producer in Arizona, although its output was 23 percent less than in 1944; its four properties (Copper Queen, Morenci, New Cornelia, and United Verde) produced 68 percent of the State gold output, more than 56 percent of the silver, and 58 percent of the copper. Other large silver producers in Arizona in 1945 were the Iron King, Magma, Trench-Flux, San Xavier (Eagle-Picher Mining & Smelting Co.), Castle Dome, and Shattuck Denn properties. More than 40 percent of the State total silver came from the Warren and Verde districts, but the output from these districts decreased 701,574 ounces from that in 1944.

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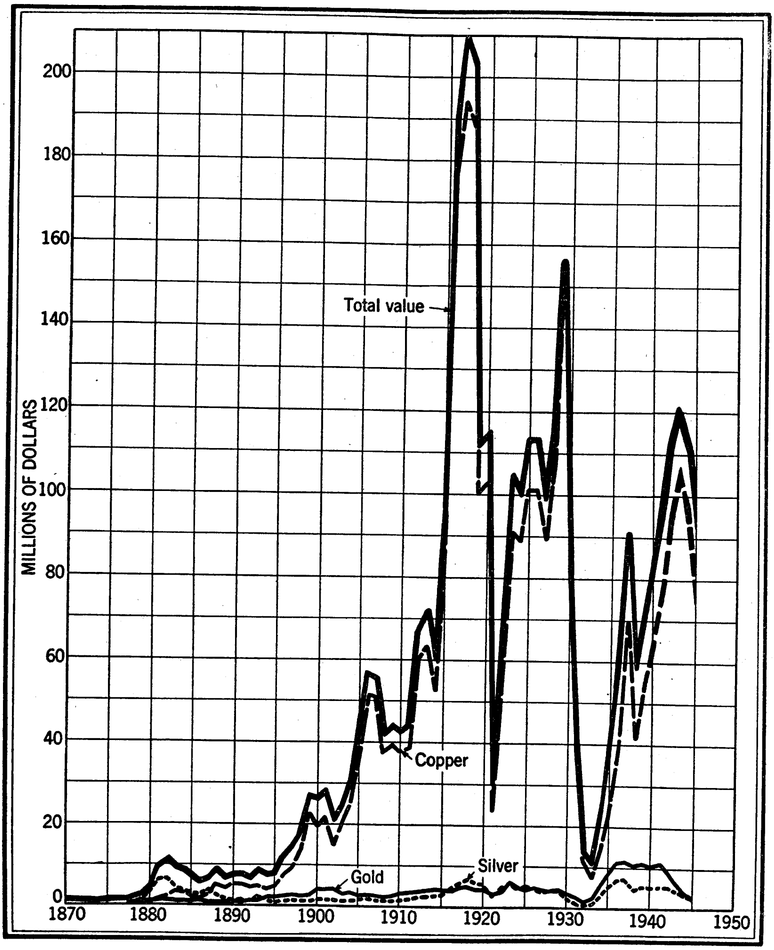

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in Arizona, 1870–1945. The value of lead and zinc has been less than $2,000,000 annually, except in a few years.

Copper.—Arizona has been the outstanding producer of copper in the United States since 1907 except in 1909, when Montana held first place. The output of recoverable copper in Arizona in 1945 was 574,406,000 pounds—a decrease of 142,200,000 pounds or 20 percent from 1944. The Copper Mountain (Morenci) district, with an output of 201,652,200 net pounds of copper, remained the leading copper-producing area in the State; it was followed by the Globe-Miami district with 157,291,400 pounds, Ajo with 75,900,000, Verde (Jerome) with 40,224,000, Mineral Creek (Ray) with 39,342,400, Warren (Bisbee) with 25,133,000, Pioneer (Superior) with 16,730,000, and Eureka (Bagdad) with 8,212,800. Marked decreases in copper output were recorded in each of these districts, particularly in the Warren (Bisbee) district where the decrease was 40,233,000 pounds. Copper ore and its products yielded 568,695,092 pounds of copper, as follows: 27,504,-

269 tons of copper ore treated by concentration yielded 80 percent; 662,730 tons of copper ore shipped crude to smelters, 10 percent; and 2,477,471 tons of copper ore leached and 13,555 tons of cement copper (from mine-water precipitates and underground leaching operations), 10 percent. The Morenci branch of the Phelps Dodge Corp. was again the largest copper producer in Arizona in 1945, although its output was less than in 1944; it was followed in order by the New Cornelia branch of the Phelps Dodge Corp., Castle Dome, Inspiration, Miami, United Verde, Ray (Kennecott Copper Corp.), Magma, Bagdad, Copper Queen, and Shattuck Denn properties.

Lead and zinc.—Each year for the past 6 Arizona has made a record output of zinc, and in 1945 the output of 80,452,000 pounds exceeded the record output of 1944 by 22,298,000 pounds or 38 percent. Production of lead in 1945 (45,734,000 pounds) was the largest in any year in the history of the State and exceeded the record output of 1944 by 12,320,000 pounds or 37 percent. These increases in both lead and zinc resulted principally from a greater output of zinc-lead ore from the Copper Queen mine of the Phelps Dodge Corp. at Bisbee. The property was the largest producer of lead and zinc in Arizona in 1945. Other large producers of lead, in order of output, were the Mammoth-St. Anthony property at Tiger, San Xavier mine near Sahuarita, Iron King mine at Humboldt, Trench-Flux group near Patagonia, and Tennessee mine at Chloride. Other large producers of zinc, in order of output, were the Iron King, Mammoth-St. Anthony, San Xavier, Magma, Trench-Flux, Republic, Duquesne, and Tennessee properties. About 41 percent of the State total lead and 45 percent of the zinc came from mines at Bisbee in Cochise County, 23 percent of the lead and more than 17 percent of the zinc from Pinal County, 9 percent of the lead and 9 percent of the zinc from mines near Sahuarita in Pima County, and more than 8 percent of the lead and 12 percent of the zinc from a mine at Humboldt in Yavapai County; most of the remaining lead and zinc output came from Santa Cruz, Mohave, Gila, and Graham Counties. About 91 percent of the total lead and 85 percent of the total zinc came from zinc-lead ore; 6 percent of the total lead came from lead ore and nearly all the rest of the lead from siliceous ores, zinc-lead-copper ore, zinc-copper ore, and zinc ore; and 10 percent of the total zinc came from zinc-copper ore and nearly all the rest of the zinc from zinc ore and zinc-lead-copper ore.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1945, by counties, in terms of recovered metals

County	Mines producing: Lode	Mines producing: Placer	Gold (lode and placer): Fine ounces	Gold (lode and placer): Value	Silver (lode and placer): Fine ounces	Silver (lode and placer): Value
Cochise	22	-------	16,274	$569,590	1,006,747	$715,909
Coconino	5	-------	4	140	6,269	4,458
Gila	22	-------	3,313	115,955	197,692	140,581
Graham	3	-------	18	630	3,389	2,410
Greenlee	6	1	6,548	229,180	405,706	288,502
Maricopa	8	2	138	4,830	879	625
Mohave	18	1	1,155	40,425	56,624	40,266
Pima	18	-------	24,869	870,415	461,371	328,086
Pinal	13	-------	5,885	205,975	367,920	261,632
Santa Cruz	13	-------	173	6,055	178,719	127,089
Yavapai	58	13	18,680	653,800	839,534	597,002
Yuma	16	1	166	5,810	33,366	23,727
	202	18	77,223	2,702,805	3,558,216	2,530,287
Total, 1944	226	17	112,162	3,925,670	4,394,039	3,124,650

County	Copper: Pounds	Copper: Value	Lead: Pounds	Lead: Value	Zinc: Pounds	Zinc: Value	Total value
Cochise	26,429,000	$3,567,915	19,713,000	$1,695,318	39,311,600	$4,520,834	$11,069,566
Coconino	822,400	111,024	-------	-------	-------	-------	115,622
Gila	158,080,000	21,340,800	905,000	77,830	492,400	56,626	21,731,792
Graham	23,000	3,105	591,000	50,826	665,000	76,475	133,446
Greenlee	201,655,000	27,223,425	-------	-------	-------	-------	27,741,107
Maricopa	4,600	621	38,000	3,268	-------	-------	9,344
Mohave	1,037,000	139,995	1,531,000	131,666	2,273,000	261,395	613,747
Pima	78,907,000	10,652,445	4,255,000	365,930	7,489,000	861,235	13,078,111
Pinal	56,797,000	7,667,595	10,712,000	921,232	14,093,000	1,620,695	10,677,129
Santa Cruz	719,000	97,065	2,904,000	249,744	4,729,000	543,835	1,023,788
Yavapai	49,805,000	6,723,675	4,188,000	360,168	11,399,000	1,310,885	9,645,530
Yuma	127,000	17,145	897,000	77,142	-------	-------	123,824
	574,406,000	77,544,810	45,734,000	3,933,124	80,452,000	9,251,980	95,963,006
Total, 1944	716,606,000	96,741,810	33,414,000	2,673,120	58,154,000	6,629,556	113,094,806

Gold and silver produced at lode mines in Arizona in 1945, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Cochise	469,283	16,274	1,006,747
Coconino	5,808	4	6,269
Gila	12,083,682	3,313	197,692
Graham	6,936	18	3,389
Greenlee	10,441,245	6,544	405,706
Maricopa	497	128	879
Mohave	32,569	1,150	56,624
Pima	5,346,632	24,869	461,371
Pinal	1,631,033	5,885	367,920
Santa Cruz	61,948	173	178,719
Yavapai	1,170,266	18,160	839,489
Yuma	17,005	165	33,366
	31,266,904	76,683	3,558,171
Total, 1944	35,900,641	111,920	4,393,949

Gold and silver produced at placer mines in Arizona in 1945, by counties, in fine ounces, in terms of recovered metals

County	Sluicing [1]		Drift mining		Dredges				Total	
					Dry-land [2]		Dragline floating [2]			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Greenlee			4						4	
Maricopa	10								10	
Mohave	5								5	
Yavapai	520	45							520	45
Yuma			1						1	
	535	45	5						540	45
Total, 1944	242	90							242	90

[1] Includes placer sands treated by dry concentration plants.
[2] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

MINING INDUSTRY

In spite of a serious shortage of labor the mining of zinc-lead ore in Arizona in 1945 was far greater than in any year in the history of the State; however, the mining of copper ore, the most important part of the State mining industry, declined from that in 1944. The marked increase in output of zinc-lead ore resulted principally from the mining of more zinc-lead ore from the Copper Queen mine at Bisbee, Iron King mine at Humboldt, and Mammoth-St. Anthony property at Tiger. The effect of the labor shortage on the domestic copper industry was especially acute in Arizona owing to the fact that the State has seven large copper-producing districts and six copper smelters. Other important factors that affected the output of ore were the suspension in July of mining zinc-copper ore from the Magma mine at Superior, suspension in October of mining zinc-lead ore from the Tennessee mine at Chloride, the undertaking early in May of mining zinc-copper ore from the Republic mine near Dragoon, and a general decline in the mining of siliceous ores. The total production of ore of all classes dropped from 35,900,641 tons in 1944 to 31,266,904 tons in 1945. The output of copper ore was 30,644,470 tons—a 13-percent loss from 1944; zinc-lead ore, 480,061 tons—a 42-percent gain; zinc-copper ore, 81,123 tons—a 16-percent loss; lead ore, 21,340 tons—a 21-percent loss; and zinc-lead-copper ore, 11,488 tons—a 38-percent loss. The output of siliceous ores was 19,506 tons compared with 129,086 tons in 1944—an 85-percent decline. Of the State total ore, 30,515,579 tons (more than 97 percent) was copper ore mined in the Globe-Miami, Copper Mountain (Morenci), Ajo, Mineral Creek (Ray), Eureka (Bagdad), Verde (Jerome), Warren (Bisbee), and Pioneer (Superior) districts; 98 percent of the State total zinc-lead ore was mined in the Warren (Bisbee), Big Bug, Old Hat (Oracle), Harshaw, Pima, and Wallapai (Chloride) districts; nearly all the zinc-lead-copper ore came from a mine in the Patagonia district; 94 percent of the zinc-copper ore came from two properties—one in the Cochise (Dragoon) district and the other in the Pioneer

(Superior) district; and 58 percent of the lead ore came from one property in the Castle Dome district. More than 62 percent of the State total siliceous ores was silver ore from properties near Duncan and Superior and gold-silver ore from properties at Tombstone. Mining operations at two open-pits—Ajo and Morenci—produced 15,689,098 tons of copper ore in 1945 compared with 17,722,944 tons in 1944.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Arizona in 1945, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	33	2,251	1,210	3,314	19,683	8,876	42,000
Dry and siliceous gold-silver ore	12	6,784	880	38,487	40,806	110792	
Dry and siliceous silver ore	16	10,471	274	105,653	14,911	866	
	61	19,506	2,364	147,454	75,400	120,534	42,000
Copper ore	85	30,644,470	62,265	[1] 2,113,537	[2] 568,695,092	62,708	
Lead ore	47	21,340	426	54,145	59,141	2,885,923	2,400
Lead-copper ore	1	2		7	290	952	
Zinc ore	6	8,914	89	14,201	136,401	149,277	2,220,788
Zinc-copper ore	5	81,123	516	76,022	1,760,435	219,716	8,107,400
Zinc-lead ore	18	480,061	10,880	1,121,992	3,332,903	41,697,193	68,491,812
Zinc-lead-copper ore	6	11,488	143	30,813	346,338	597,697	1,587,600
Total, lode mines	[3] 202	31,266,904	76,683	[1] 3,558,171	[2] 574,406,000	45,734,000	80,452,000
Total, placers	18		540	45			
	220	31,266,904	77,223	3,558,216	574,406,000	45,734,000	80,452,000
Total, 1944	243	35,900,641	112,162	[4] 4,394,039	[5] 716,606,000	33,414,000	58,154,000

[1] Includes 322 ounces recovered from underground mine-water precipitates.
[2] Includes 56,344,468 pounds recovered from ore leached and mine-water precipitates.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 295 ounces recovered from underground mine-water precipitates.
[5] Includes 79,003,481 pounds recovered from ore leached and mine-water precipitates.

METALLURGIC INDUSTRY

Of the 31,266,904 tons of ore produced in 1945 in Arizona, 28,098,648 tons (90 percent) were treated at concentration plants, 2,477,471 tons (8 percent) at two leaching plants, 200 tons at a cyanidation plant, and 6 tons at an amalgamation plant; 690,579 tons (2 percent) were shipped crude to smelters.

Ore treated at concentration plants in 1945 comprised chiefly 27,504,269 tons of copper ore, 480,003 tons of zinc-lead ore, 81,123 tons of zinc-copper ore, 13,130 tons of lead ore, and 11,488 tons of zinc-lead-copper ore. Copper ore from the Miami property was treated by a combination of leaching and concentration, copper ore from the Inspiration mine was treated by straight leaching and by leaching and concentration, and copper ore from the Emerald Isle mine was treated by straight leaching. The large copper-concentration plants at Morenci (45,000-ton-a-day), Ajo (25,000-ton), Clarkdale (2,100-ton), Hayden (10,000-ton), Miami (18,000-ton), Inspiration (18,000-ton), Bagdad (2,500-ton), and Superior (850-ton) were operated continuously in 1945 but at a much lower rate than in 1944. The 10,000-ton copper concentrator of the Castle Dome Copper Co., Inc., near Miami was the only plant that operated at a higher rate than in 1944. The copper-leaching plants at Inspiration (9,000-ton) and Miami (3,000-ton) and the copper smelters at Clarkdale, Douglas, Hayden, Miami, Morenci, and Superior were operated also at a reduced rate. The rated capacity of charge of the six copper smelters was as follows: Clarkdale, 1,400,000 tons per year; Douglas, 1,600,000; Hayden, 360,000; Miami, 360,000; Morenci, 600,000; and Superior (Magma), 210,000. The Phelps Dodge Corp. reported that the Douglas smelter operated throughout the year on a reduced two-furnace basis and smelted 448,612 tons (925,431 tons in 1944) of new material. Much experimental work was done in connection with different types of furnace charge. Under present conditions of ore receipts raw charging has been adopted, and the roasting of ores and concentrates has been discontinued. The smelter at Clarkdale treated 353,603 tons of new material in 1945 compared with 518,627 tons in 1944; only one reverberatory furnace was operated throughout the year, and during the latter half of the year only one converter was necessary. The Morenci smelter treated 390,949 tons of new material in 1945 compared with 422,320 tons in 1944; two reverberatory furnaces and three converters were operated throughout the year. Both furnace and converter practices were improved. Labor shortages prevented full utilization of smelting facilities, and surplus concentrates were shipped to the Douglas smelter. Nearly all the lead concentrates produced at mills in Arizona in 1945 were shipped to the smelter at El Paso, Tex., and all the zinc concentrates were shipped to smelters at Amarillo, Dumas, and Corpus Christi, Tex., and Bartlesville, Okla.

The following tables give details of the treatment of all ores produced in Arizona in 1945.

Mine production of metals in Arizona in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	6	25	5			
Old tailings cyanided	200	4	455			
Concentrates smelted	1,013,484	51,573	2,393,737	460,719,258	43,397,346	80,032,845
Ore smelted	690,579	25,081	1,163,652	57,342,274	2,336,654	419,155
Copper precipitates smelted	13,555		322	[1] 20,193,515		
Copper ore leached	[2] 2,477,471			36,150,953		
Placer		540	45			
		77,223	3,558,216	574,406,000	45,734,000	80,452,000
Total, 1944		112,162	4,394,039	716,606,000	33,414,000	58,154,000

[1] Distributed as follows: Cochise County, 601,250 pounds; Gila County, 7,667,942 pounds; Greenlee County, 1,026,700 pounds; Mohave County, 136,050 pounds; Pinal County, 10,356,373 pounds; and Yavapai County, 405,200 pounds.
[2] Treated by straight leaching at 1 plant in Gila County and 1 plant in Mohave County.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Arizona in 1945, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Pinal	3	15	3						
Yavapai	3	10	2						
	6	25	5						
Total, 1944	(1)								

CYANIDATION MILLS

County	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Greenlee	200	4	455						
	200	4	455						
Total, 1944	30,443	656	1,767	882	5,152	2,408	480	637,255	
Grand total, 1945	206	29	460						
1944	30,443	656	1,767	882	5,152	2,408	480	637,255	

[1] None treated at amalgamation mills in 1944.

Mine production of metals from concentrating mills in Arizona in 1945, by counties, in terms of recovered metals

County	Material treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	209,905	62,747	1,798	406,697	2,368,860	18,709,700	39,311,600
Coconino	540	179		171	33,200		
Gila	9,569,958	157,042	3,122	172,402	112,077,810	690,500	492,400
Graham	6,030	1,072		850	3,650	341,260	665,000
Greenlee	10,390,862	381,082	6,190	342,000	199,575,000		
Mohave	20,849	6,065	1,011	47,888	363,778	1,460,524	2,262,950
Pima	5,310,097	143,210	24,817	429,155	76,923,048	4,052,113	7,489,000
Pinal	1,594,886	123,906	4,752	302,443	42,090,316	10,655,000	14,093,000
Santa Cruz	54,839	7,363	93	171,075	386,808	2,628,960	4,729,000
Yavapai	927,982	129,956	9,788	505,729	26,896,388	4,049,976	10,989,895
Yuma	12,700	862	2	15,327	400	809,313	
	28,098,648	1,013,484	51,573	2,393,737	460,719,258	43,397,346	80,032,845
Total, 1944	31,543,180	1,215,293	55,558	2,370,259	537,637,669	29,652,876	57,755,263

Gross metal content of concentrates produced from ores mined in Arizona in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry silver	1	-----	150	-----	-----	-----
Copper	875,407	41,646	1,278,168	468,955,458	69,911	6,120,949
Lead	41,331	8,096	812,965	2,610,039	37,829,002	7,440,411
Lead-copper	4,853	135	145,352	819,037	4,522,001	1,213,616
Zinc	85,709	2,625	359,296	1,690,599	5,865,819	89,577,358
Zinc-copper	18	50	963	3,107	1,400	17,288
Zinc-lead	3	-----	12	40	1,200	2,650
Zinc-lead-copper	41	3	2,630	14,049	45,863	27,686
Iron	6,121	1,418	12,622	43,873	111,235	734,604
	1,013,484	53,973	2,612,158	474,136,202	48,446,431	105,134,562
Total, 1944	1,216,175	64,186	2,615,919	553,213,239	34,860,196	82,933,351

Mine production of metals from Arizona concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	62,747	1,798	406,697	2,368,860	18,709,700	39,311,600
Coconino	179	-----	171	33,200	-----	-----
Gila	157,042	3,122	172,402	112,077,810	690,500	492,400
Graham	1,072	-----	850	3,650	341,260	665,000
Greenlee	381,082	6,190	342,000	199,575,000	-----	-----
Mohave	6,065	1,011	47,888	363,778	1,460,524	2,262,950
Pima	143,210	24,817	429,155	76,923,048	4,052,113	7,489,000
Pinal	123,906	4,752	302,443	42,090,316	10,655,000	14,093,000
Santa Cruz	7,363	93	171,075	386,808	2,628,960	4,729,000
Yavapai	129,956	9,788	505,729	26,896,388	4,049,976	10,989,895
Yuma	862	2	15,327	400	809,313	-----
	1,013,484	51,573	2,393,737	460,719,258	43,397,346	80,032,845
Total, 1944	1,216,175	60,710	2,372,667	537,638,149	30,290,131	57,755,263

BY CLASSES OF CONCENTRATES

Dry silver	1	-----	150	-----	-----	-----
Copper	875,407	40,203	1,198,668	456,620,271	20,760	-----
Lead	41,331	8,096	812,965	2,215,734	36,045,044	-----
Lead-copper	4,853	135	144,952	697,845	4,298,107	-----
Zinc	85,709	1,668	221,118	1,138,390	2,881,960	79,995,814
Zinc-copper	18	50	620	2,727	840	14,600
Zinc-lead	3	-----	12	30	720	2,400
Zinc-lead-copper	41	3	2,630	11,941	45,060	20,031
Iron	6,121	1,418	12,622	32,320	104,855	-----
	1,013,484	51,573	2,393,737	460,719,258	43,397,346	80,032,845

Gross metal content of Arizona crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	1,495	1,015	2,411	19,265	9,341	3,382
Dry and siliceous gold-silver	6,784	880	38,487	43,537	177,379	57,640
Dry and siliceous silver	10,264	270	105,048	15,725	1,195	
Copper	662,730	22,457	970,897	60,721,282	96,895	6,148,700
Lead	8,210	424	38,578	70,307	2,134,264	361,399
Lead-copper	2		7	315	1,014	
Zinc	1,036	11	6,358	50,444	81,130	564,378
Zinc-lead	58	24	1,866	4,131	53,284	13,895
	690,579	25,081	1,163,652	60,925,006	2,554,502	7,149,394
Total, 1944	1,195,658	50,630	2,020,700	107,477,586	3,560,048	6,387,526

Mine production of metals from Arizona crude ore shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Cochise	259,378	14,476	599,728	23,458,890	1,003,300	
Coconino	5,268	4	6,098	789,200		
Gila	41,253	191	25,290	2,183,295	214,500	
Graham	906	18	2,539	19,350	249,740	
Greenlee	50,183	350	63,251	1,053,300		
Maricopa	497	128	879	4,600	38,000	
Mohave	6,720	139	8,736	537,172	70,476	10,050
Pima	36,535	52	32,216	1,983,952	202,887	
Pinal	36,144	1,118	65,474	4,350,311	57,000	
Santa Cruz	7,109	80	7,644	332,192	275,040	
Yavapai	242,281	8,362	333,758	22,503,412	133,024	409,105
Yuma	4,305	163	18,039	126,600	87,687	
	690,579	25,081	1,163,652	57,342,274	2,336,654	419,155
Total, 1944	1,195,658	50,554	2,019,220	99,964,370	3,123,869	398,737

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	1,495	1,015	2,411	18,113	2,376	
Dry and siliceous gold-silver	6,784	880	38,487	40,806	110,792	
Dry and siliceous silver	10,264	270	105,048	14,911	866	
Copper	662,730	22,457	970,897	57,163,233	62,708	
Lead	8,210	424	38,578	58,541	2,026,890	
Lead-copper	2		7	290	952	
Zinc	1,036	11	6,358	42,880	79,700	409,105
Zinc-lead	58	24	1,866	3,500	52,370	10,050
	690,579	25,081	1,163,652	57,342,274	2,336,654	419,155

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Cochise County:													
California	2		1,062	3		3	2,226		2,226	18,200	321,500		$31,794
Cochise	2		33,183	8		8	6,217		6,217	985,000	3,500	2,600,000	436,977
Dos Cabezas and Tevis	2		2,289	17		17	7,051		7,051	180,000	11,500		30,898
Hartford (Huachuca Mountains)	2		362	5		5	1,935		1,935	3,200	27,500	55,000	10,673
Swisshelm	3		1,782	99		99	6,345		6,345	2,400	351,000		38,487
Tombstone	4		4,549	259		259	17,093		17,093	14,600	184,000		39,015
Turquoise	4		2,285	20		20	2,700		2,700	92,600	13,500	500,000	73,782
Warren (Bisbee)	3		423,771	15,863		15,863	963,180		963,180	25,133,000	18,800,500	36,156,600	10,407,940
Coconino County:													
Jacob Canyon and Warm Springs	4		5,216	4		4	6,030		6,030	784,400			110,322
Kaibito Plateau	1		592				239		239	38,000			5,300
Gila County:													
Banner and Dripping Springs	4		21,993	122		122	13,140		13,140	775,600	690,500	492,400	234,329
Globe-Miami	14		12,061,300	3,160		3,160	183,794		183,794	157,291,400	214,500		21,494,084
Green Valley	1		23	21		21	7		7	1,200			902
Pioneer (Pinal Mountains)	2		67	7		7	751		751	4,600			1,400
Summit	1		299	3		3				7,200			1,077
Graham County:													
Aravaipa	2		6,917	17		17	3,344		3,344	23,000	581,000	665,000	132,519
Stanley	1		19	1		1	45		45		10,000		927
Greenlee County:													
Ash Peak	3		6,819	243		243	59,843		59,843	2,800			51,438
Copper Mountain (Morenci)	3		10,434,426	6,301		6,301	345,863		345,863	201,652,200			27,689,529
San Francisco River		1			4	4							140
Maricopa County:													
Ellsworth (Harqua Hala)[1]	1		8	1		1	7		7	400			94
Hassayampa River		1			8	8							280
Osborn	2		289	69		69	775		775	3,600	36,500		6,591
Vulture	3	1	12	6	2	8	24		24		1,000		383
White Picacho[2]	1		2				7		7	200			32
Wickenburg	1		186	52		52	66		66	400	500		1,964
Mohave County:													
Cedar Valley	2		7,592	42		42	6,210		6,210	540,200	28,000	906,000	185,411
Gold Basin		1			5	5							175
Hacks Canyon	1		178				540		540	22,000			3,354
Owens (McCracken and Potts Mountain)	2		335	4		4	45		45	20,000			2,872
San Francisco (Oatman, Goldroad, Katherine, Vivian)	1		1	10		10	17		17				362
Wallapai	11		24,462	1,063		1,063	49,708		49,708	454,800	1,503,000	1,367,000	420,414
Weaver	1		1	31		31	104		104				1,159

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in Arizona in 1945, by counties and districts, in terms of recovered metals—Continued

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Pima County:													
Ajo	1		5,256,445	24,772		24,772	285,719		285,719	75,900,000			$11,316,698
Amole	1		172	5		5	339		339	200	9,000	17,000	3,172
Baboquivari	1		144	6		6	883		883	6,000			1,648
Helvetia (Rosemont)	7		29,188	16		16	10,239		10,239	1,516,600	29,500	78,000	224,089
Old Hat [3]	1		11,579	32		32	8,325		8,325	543,200			80,372
Pima (Sierritas, Papago, Twin Buttes)	3		42,875	27		27	137,503		137,503	570,000	4,126,000	7,394,000	1,380,821
Quijatoa	1		1				76		76				54
Roskruge and Waterman (Silver Hill)	1		5,655	8		8	13,967		13,967	355,000	38,000		61,405
Silver Bell	2		573	3		3	4,320		4,320	16,000	52,500		9,852
Pinal County:													
Bunker Hill	1		58				21		21	7,600			1,041
Martinez Canyon	1		555				405		405		92,000		8,200
Mineral Creek (Ray)	2		1,374,271	426		426	35,550		35,550	39,342,400			5,351,414
Mineral Hill	2		98	9		9	69		69	5,600			1,120
Old Hat [3]	2		76,078	439		439	80,730		80,730	675,000	10,432,000	9,500,000	2,153,550
Pioneer (Superior)	4		179,613	5,007		5,007	251,062		251,062	16,730,000	188,000	4,593,000	3,156,691
Summit	1		360	4		4	83		83	36,400			5,113
Santa Cruz County:													
Harshaw	2		44,547	49		49	144,841		144,841	126,200	2,132,000	3,332,800	688,374
Oro Blanco	1		414	53		53	4,192		4,192	3,200	65,000	19,800	13,135
Palmetto	1		5,251							295,000			39,825
Patagonia (Duquesne)	5		10,019	5		5	23,227		23,227	274,600	497,000	1,366,800	253,687
Tyndall	3		1,677	66		66	6,404		6,404	20,000	205,500	9,600	28,341
Wrightson	1		40				55		55		4,500		426
Yavapai County:													
Agua Fria	3		6,406	44		44	945		945	346,200			48,949
Big Bug	5	2	131,424	7,903	492	8,395	320,514	45	320,559	517,600	3,961,000	9,844,000	2,064,360
Black Canyon	7		188	99		99	1,267		1,267	2,000	2,500	7,400	5,702
Black Hills	1		10				59		59	800			150
Blue Tank		2			2	2							70
Bullard (Pierce)	1		175	17		17	163		163	5,200			1,413
Castle Creek		1			1	1							35
Cherry Creek	1		14	14		14	14		14				500
Copper Basin	2		12,515	28		28	2,364		2,364	462,200	41,500	650,000	143,377
Eureka (Bagdad)	9	2	625,027	395	10	405	33,141		33,141	8,212,800	151,500	850,400	1,257,295
Hassayampa (Groom Creek, Hassayampa River, Senator, Prescott)	4	1	50	21	3	24	270		270	800	2,500	800	1,447
Peck	1		22				495		495	200			379
Pine Grove	3		1,209	221		221	1,516		1,516	22,400	6,500	42,000	17,226
Squaw Peak	1		145				17		17	4,800			660
Tiger	2		307	549		549	1,035		1,035	3,400			20,410

Verde (Jerome)	5		392,295	8,602		8,602	475,290		475,290	40,224,000			6,069,294
Wagoner		2			4	4							140
Walker	7	1	168	165	3	168	540		540	600	21,000	4,400	8,657
Weaver	3	2	156	44	5	49	38		38	200			1,769
White Picacho [2]	3		155	58		58	1,821		1,821	1,800	1,500		3,697
Yuma County:													
Castle Dome	2		12,761	2		2	18,502		18,502	400	889,500		89,778
Cienega	3		174	42		42	38		38	6,000			2,307
Ellsworth (Harqua Hala) [1]	1		3,617	109		109	990		990	118,200			20,476
Kofa Mountains	1		1	3		3	7		7				110
Plomosa	7	1	447	9	1	10	13,829		13,829	2,000	7,500		11,099
Santa Maria (Planet, Bill Williams)	2		5							400			54
Total, Arizona	202	18	31,266,904	76,683	540	77,223	3,558,171	45	3,558,216	574,406,000	45,734,000	80,452,000	95,963,006

[1] Ellsworth district lies in both Maricopa and Yuma Counties.
[2] White Picacho district lies in both Maricopa and Yavapai Counties.
[3] Old Hat district lies in both Pima and Pinal Counties.

COCHISE COUNTY

California district (Hilltop).—A lessee operated the Crosby mine near Portal until November 1 and shipped 876 tons of carbonate lead ore and 168 tons of siliceous copper ore to smelters; the lease was abandoned in November. The rest of the district output was small lots of lead ore and silver ore produced from the El Tigre claim.

Cochise district.—The Coronado Copper & Zinc Co., owner of the Republic mine near Dragoon, completed in May a 150-ton flotation mill at the mine. During the remainder of the year the mill treated 30,289 tons of zinc-copper ore, which yielded 1,066 tons of copper concentrate and 2,745 tons of zinc concentrate. Lessees operated the Mammoth mine (also owned by the Coronado Copper & Zinc Co.) the first 7 months of the year and shipped 2,894 tons of siliceous copper ore to the smelter at Douglas.

Dos Cabezas and Tevis district.—Shipments of highly siliceous copper ore were made throughout the year by a lessee operating the Elma claim of the Tout group; the total output of 2,287 tons was shipped to the copper smelter at El Paso, Tex.

Hartford (Huachuca Mountains) district.—Development, by the owners, of the State of Texas mine near Hereford resulted in the shipments of 7 cars (357 tons) of zinc-lead ore to a custom flotation mill at Bisbee. The rest of the district output was small lots of lead ore and lead-copper ore produced from the James mine.

Swisshelm district (Elfrida).—Lessees continued in 1945 to operate the Scribner mine near Elfrida and shipped 1,729 tons of silver-lead ore to the lead smelter at El Paso, Tex. A car of similar ore also was shipped from the Chance claim.

Tombstone district.—The output of the Tombstone district in 1945 was 3,860 tons of old siliceous tailings, containing principally gold, silver, and lead, and 689 tons of silver-lead ore shipped direct to smelters. All the old tailings came from the Grand Central dump near Fairbank and virtually all the silver-lead ore from the Tombstone Extension and Silver Bill properties at Tombstone.

Turquoise district (Courtland, Pearce, Gleeson).—Bargin Mines, Inc., operated under lease the Abril group near Pearce from January 5 to October 5, 1945, and shipped 1,614 tons of zinc ore to a custom mill at Bisbee. In December the property was taken over, under option to purchase, by the Shattuck Denn Mining Corp. The remainder of the district output comprised 379 tons of copper ore produced from the Shannon group, 261 tons of lead ore and copper ore from the Tom Scott mine, and 31 tons of copper ore from the Leadville mine.

Warren district (Bisbee, Warren).—In 1945 the Warren district ranked first in the State in output of silver, lead, and zinc, second in gold, and sixth in copper; however, the output of gold dropped to 15,863 ounces (a 59-percent loss from 1944), silver to 963,180 ounces (a 38-percent loss), and copper to 25,133,000 pounds (more than 61-percent loss). The output of lead increased to 18,800,500 pounds (a 169-percent gain) and zinc to 36,156,600 pounds (a 124-percent gain). The decline in production of gold, silver, and copper was due to the drop in output of copper ore from the Copper Queen branch of the Phelps Dodge Corp.; however, the increase in production of lead and zinc resulted from the marked rise in output of zinc-lead ore from this property. The corporation reported that 185,394 tons of copper ore were mined and smelted in 1945 compared with 634,650 tons in 1944 and that 177,513 tons of zinc-lead ore were treated in various flotation mills compared with 55,571 tons. In addition, 677 tons of copper precipitates were produced by surface and underground precipitation plants and sent to the corporation smelter at Douglas.

According to the corporation annual report for 1945, mining operations were seriously hampered throughout the year by an acute shortage of manpower, resulting in a marked decline in the production of gold, silver, and copper. Exploration and development were necessarily curtailed and comprised 15,354 feet of drifting, crosscutting, and raising, 5,649 feet of stope preparation, and 34,180 feet of diamond drilling. In spite of the reduced development, ore reserves were adequately maintained; several interesting developments and extensions were discovered in the zinc-lead ore areas. The erection of a zinc-lead ore concentrator, with a daily capacity of 450 tons and producing both lead and zinc concentrates, was completed in November. As a result, zinc-lead ore shipments previously made to custom concentrators were greatly reduced.

Mining and milling operations at the Denn property of the Shattuck Denn Mining Corp. were continuous throughout the year; however, the corporation 150-ton zinc-lead ore concentrator was utilized in 1945 entirely for the treatment of custom ores. The corporation reported that the Denn mine produced 59,672 tons of copper ore in 1945, which was sent to the smelter at El Paso, and that the concentrator treated 58,134 tons of zinc-lead ore for custom shippers. About 91 percent of the custom ore was zinc-lead ore received from the Copper Queen mine at Bisbee.

According to the corporation annual report for 1945, no new ore was found at the Denn mine; the known ore of commercial grade above the 2,900 level—the present lowest level of the mine—is limited in quantity, and mining conditions underground are difficult and costly.

The remainder of the district output was 773 tons of copper ore, 188 tons of gold-silver ore, and 26 tons of copper precipitates shipped by a lessee working the Shattuck mine.

COCONINO COUNTY

Jacob Canyon and Warm Springs district—Atherley & Ryan continued in 1945 to operate under lease the Mackin-Kennedy-Ryan group and the Petoskey group near Jacobs Lake and shipped 5,119 tons of carbonate copper ore to the smelter at Garfield, Utah; the ore was mined by a power shovel from surface pits at both groups. Similar ore was produced also from the Brown Derby and Little Buck properties.

Kaibito Plateau district.—The Mardun Co. operated the Mardun mine, 57 miles north of Cameron, from January 1 to July 1, 1945; about 540 tons of copper ore were treated in the company 120-ton concentration plant, and 52 tons of similar ore were shipped direct to a smelter.

GILA COUNTY

Banner and Dripping Springs district.—Mining of high-lime fluxing ore, needed by the copper smelter at Hayden, was continuous throughout the year at the Christmas mine by Sam Knight Mining Lease, Inc.; 19,260 tons of ore containing principally copper, were shipped to the smelter in 1945. According to an information circular released March 12, 1946, by the Geological Survey, the Christmas mine has produced over 27,500 tons of copper since it was opened in 1905. The ore is in flat, tabular bodies, which are replacements of certain favorable limestone beds close to the limestone-diorite contact. Accessible ore reserves were nearly depleted at the time (fall of 1942) a study was undertaken by the Geological Survey, in cooperation with the Bureau of Mines. Sufficient ore was developed by the exploration-drilling campaign in 1943 and early 1944 to allow continued operation of the mine for several years. The rest of the district output in 1945 was mainly 2,708 tons of zinc-lead ore produced from the "79" mine by the 79 Lead-Copper Co. and treated in the Shattuck Denn custom mill at Bisbee.

Globe-Miami district.—The Globe-Miami district, with a production of 157,291,400 net pounds of copper in 1945 (190,609,200 net pounds in 1944), ranked second among the important copper-producing areas in Arizona; the Copper Mountain (Morenci) district in Greenlee County remained in first place. The Castle Dome Copper Co., Inc., a wholly owned subsidiary of the Miami Copper Co., with a yield of 53,341,226 net pounds of copper (49,987,529 net pounds in 1944), was the chief producer of copper in the district and ranked third in the State. The company reported that 4,183,769 tons of ore averaging 0.743 percent copper were treated in the 12,000-ton concentrator leased from the Defense Plant Corporation. In addition to copper, the concentrates contained 1,860 ounces of gold and 100,395 ounces of silver.

According to the annual report of the Miami Copper Co. for 1945, the Castle Dome open pit, unlike underground mine operations, was not hampered by a labor shortage, and the property was operated at full capacity 3 shifts a day 7 days a week throughout the year, except 5 days lost on national holidays and 5 days lost through failure of equipment. At the tailings-disposal site a major improvement, begun in 1944, was completed and put in operation. It will permit a much larger tonnage of tailings to be deposited and greatly simplify the disposal of tailings, which will reduce the cost of operations. A geological study made early in the year indicated the possibility of an occurrence of commercial ore lying northeast of the known ore body, but after 7 exploratory holes were drilled in it to an average depth of 385 feet no commercial ore was found. The drilling equipment was moved to an area lying southwest of the known ore body, and 10 holes were drilled in this area with promising results. Ore reserves as of January 1, 1946, are estimated to be 19,003,782 tons averaging 0.74 percent copper.

The Inspiration property, with a yield of 53,292,670 net pounds of copper in 1945 (81,996,557 net pounds in 1944), ranked second in copper production in the district. This marked decrease in production resulted from a labor shortage, which hampered all operations throughout the year. The Inspiration Consolidated Copper Co. reported that 3,852,543 tons of copper ore and tailings were treated in 1945 compared with 4,545,134 tons of ore and tailings in 1944. Of the total ore, 2,472,471 tons, averaging 1.170 percent copper—0.527 percent copper as oxide and 0.643 percent as sulfide—from which the slimes had been removed, were treated in the main leaching plant; 199,899 tons of slimes, averaging 1.223 percent copper, and 1,180,173 tons of leached ore, averaging 0.749 percent copper, from the main leaching plant were treated in the company concentrator. Sulfuric acid leaching, for extraction of the oxide copper content of the ore, was used to treat 1,096,760 tons of ore in the main leaching plant during the first 6 months of the year. During the last 6 months, 1,375,711 tons of ore were leached by acid ferric sulfate. Slimes removed from ore at the main leaching plant were treated by flotation concentration for extraction of the sulfide copper content, and the tailings were leached with sulfuric acid for extraction of the oxide copper content. The total copper production per ton of ore treated in 1945 was 20.526 pounds.

According to the annual report of the company for 1945, ore mined during the year totaled 2,672,370 dry tons assaying 1.174 percent copper—0.546 percent as oxide and 0.628 percent as sulfide. Of the total ore mined, 61,268 tons were from development. The area undercut and caved during the year was 2.219 acres. Total underground development aggregated 22,378 feet of drifts and raises and 1,566 cubic yards of miscellaneous development. During the first half of the year the "dual process" (combined leaching and concentration) of ore treatment was continued, pending completion of reconstruction of the electrolytic tank house, which was destroyed by fire October 1, 1944. This reconstruction was completed in the latter part of May 1945, when ore treatment by the dual process was discontinued and treatment by the ferric sulfate process resumed.

Mining and milling at the Miami property of the Miami Copper Co. were continuous throughout the year. The company 18,000-ton concentrator and 3,000-ton leaching plant treated 4,003,409 tons (4,717,138 tons in 1944) of ore averaging 0.644 percent copper, and 2,993 tons of copper precipitates were produced from leaching of ore in place. In addition, 571 tons of molybdenum concentrate were recovered as a byproduct in treating copper ore.

According to the annual report of the company for 1945, the loss in copper production at the Miami mine resulted entirely from a severe shortage of underground labor. Mine development during the year comprised 3,909 feet of drifts and 3,737 feet of raises; in addition, 13,711 feet of drifts and raises were driven for stoping account. In line with the low development footage, ore mined was low at an average daily rate of 11,121 tons for the 360 days of mine operations. The manpower situation reached a low point in October but picked up in an encouraging manner during the remainder of the year. As the mining of ore in place progresses, the problem of leaching copper from the broken stope fill remaining becomes more important. The total copper recovered in this manner since leaching started in 1941 has been 22,551,073 pounds. Virtually all of this copper was leached from oxidized copper minerals by water containing sulfuric acid. Nearly all of the copper remaining to be leached is contained in sulfide copper minerals, mostly chalcocite. To leach this copper will require a solvent containing both acid and ferric sulfate. To produce the solvent, in order to test the leaching process, a pilot plant was designed, and its construction is nearing completion. Ore reserves as of January 1, 1946, are estimated to be 39,109,637 tons averaging 0.855 percent copper.

The rest of the district output was principally 19,329 tons of copper ore shipped direct to smelters; 8,762 tons came from various claims and waste dumps of the Old Dominion property, 7,165 tons from the Carlota mine, 2,306 tons from the Van Dyke mine, 746 tons from the Superior & Boston property, and 350 tons from the Al & Hal group. Ceferino Liano operated his Albert Lea mine throughout the year and shipped 769 tons of lead ore to the smelter at El Paso.

Green Valley district.—In 1945 the Summit mine near Payson was under development by the Summit Copper Mines, Inc., and 23 tons of gold-copper ore were shipped to the copper smelter at Miami.

Pioneer (Pinal Mountains) district.—Lessees continued in 1945 to work the Mariana and Bob Tail claims and shipped a total of 67 tons of silver-copper ore to a smelter.

Summit district.—In 1945, as in 1944, the only output in the Summit district was copper ore shipped to a smelter from the Gibson waste dump west of Miami.

GRAHAM COUNTY

Aravaipa district.—The Athletic Mining Co. operated the Aravaipa group near Klondyke continuously in 1945 and shipped 6,030 tons of zinc-lead ore to the flotation mill of the Eagle-Picher Mining & Smelting Co. near Sahuarita and 882 tons of silver-lead ore to the lead smelter at El Paso, Tex. A little (5 tons) silver-lead ore was produced also from the Lead Jewel claim.

Stanley district.—Some lead ore (19 tons) was produced in 1945 from the Dos Amigos mine southeast of the Coolidge Dam.

GREENLEE COUNTY

Ash Peak district.—Fluxing ore, needed by the International copper smelter at Miami, remained the principal output in the Ash Peak district. The ore (6,573 tons) was produced from the Ash Peak mine by the Ash Peak Lease and averaged 0.036 ounce of gold and 8.97 ounces of silver to the ton and 84.40 percent silica. The rest of the district output was 200 tons of old tailings (silver), treated by cyanidation, from the Ash Peak property and 46 tons of silver ore produced from the Golden Eagle (Hardy) mine.

Copper Mountain district (Morenci).—The Copper Mountain district, with a production of 201,652,200 net pounds of copper in 1945 (213,851,000 net pounds in 1944), remained the chief copper-producing area in Arizona. The Morenci mine of the Phelps Dodge Corp. again was the outstanding producer of copper in the State. The company reported that 10,390,862 tons of copper ore were treated in the combined (Phelps Dodge and Defense Plant Corp.) 45,000-ton concentrator and that 41,791 tons of crude copper ore and 1,019 tons of copper precipitates were shipped direct to the Morenci smelter.

According to the annual report of the Phelps Dodge Corp. for 1945, production of ore from the Morenci open pit totaled 10,432,653 tons, and waste stripped totaled 11,586,169 tons. Mining operations were conducted on 19 benches, the top bench being the 5,500 and lowest the 4,600. Three additional stripping benches were opened on the west side of the pit and were completed to pit limits. A diamond drilling program to determine more definitely the stripping limits at the northwest corner of the ore body was in progress at the end of the year. Metallurgical research at the concentrator improved the ratio of concentration and therefore the copper content of the concentrate.

Nearly all the rest of the district output was crude, high-silica, copper oxide ore (1,698 tons) shipped to the Morenci smelter from the Keating mine, operated under lease by the Auto Specialties Manufacturing Co.

MARICOPA COUNTY

Osborn district.—Nearly all the output in the Osborn district in 1945 was 232 tons of lead ore and 56 tons of gold ore shipped to a smelter from the Belmont-McNeil mine southwest of Wickenburg. The property was worked in January by the East Vulture Mining Co. and during the last 9 months of the year by Ralph Pfeffer, both lessees.

Vulture district.—The output of the Vulture district was small in 1945—7 tons of gold ore were produced from the Lucky Cuss claim, 4 tons of silver ore from the Cumberland claim, and 1 ton of lead ore from the Nugget claim. In addition, 2 ounces of placer gold were recovered from the Vulture property.

Wickenburg district.—Old tailings (186 tons), containing principally gold, remained the only output in the Wickenburg district.

MOHAVE COUNTY

Cedar Valley district.—The Arizona Antlers Mining Co. operated the Antler mine 20 miles southwest of Yucca throughout the year and shipped 2,028 tons of zinc-copper ore to a custom flotation mill at Midvale, Utah, for treatment. Similar ore (2,991 tons) was produced from the Copper World mine by the Dye & Bathrick Mining Co. and also shipped to Midvale for treatment; in addition, 2,573 tons of copper ore were shipped to the United Verde copper smelter at Clarkdale, Ariz.

Hacks Canyon district.—Carbonate copper ore (178 tons) continued in 1945 to be mined from shallow depths of the Hacks Canyon mine by the Canyon Copper Co. and shipped to the smelter at Miami.

Owens (McCracken and Potts Mountain) district.—Leasing operations at the Stein mine produced 334 tons of copper ore, which was shipped direct to a smelter.

Wallapai district (Cerbat, Chloride, Mineral Park, Stockton Hill).—The Mines Operating Co., an organization of a few employees of the Tennessee Schuylkill Corp., worked the Tennessee mine and 150-ton flotation mill at Chloride from January 1 to October 20, 1945, when all operations ceased. During the year 11,523 tons of ore, averaging 0.075 ounce of gold and 2.517 ounces of silver to the ton, 6.005 percent lead, and 7.168 percent zinc, were treated in the mill, which yielded 966 tons of lead concentrates and 1,164 tons of zinc concentrates. Mining of carbonate copper ore from the Emerald Isle mine by the Emerald Isle Copper Co. was continuous throughout the year. The company treated, by sulfuric acid, about 5,000 tons of copper ore in its new 300-ton leaching plant and shipped 3,312 tons of similar ore direct to the United Verde smelter at Clarkdale. Ralph R. Langley, owner of the Summit group north of Kingman, worked his property continuously in 1945 and shipped 3,473 tons of zinc-lead ore to custom milling plants in Arizona and Utah. The rest of the district output was principally 892 tons of zinc-lead ore from the Eureka, Juno, Lone Jack, and New London properties and 206 tons of gold-silver ore from the White Eagle mine.

Weaver district.—The only output in the Weaver district in 1945 was old mill cleanings, containing mainly gold, recovered from the Pilgrim mill near Chloride.

PIMA COUNTY

Ajo district.—As usual, the output of the Ajo district was all copper ore from the New Cornelia mine of the Phelps Dodge Corp. In 1945 the district ranked first in gold, third in copper, and fifth in silver output in the State. According to the annual report of the Phelps Dodge Corp. for 1945, the New Cornelia open pit and 25,000-ton concentrator were operated continuously throughout the year; production amounted to 5,255,672 tons of copper ore and 3,555,348 tons of waste. The concentrator treated 5,256,445 tons of ore with metallurgical results comparable with those in 1944.

Amole district.—The old Palo Verde mine, 11 miles west of Tucson, was reopened by the owners in 1945 after being idle for the past 20 years. The mine was unwatered to the 215-foot level and retimbered; 172 tons of zinc-lead ore were hauled to the Eagle-Picher mill near Sahuarita.

Baboquivari district.—Leasing operations at the Papago Chief mine produced 144 tons of high-silica silver-copper ore, which was shipped to the smelter at Hayden.

Helvetia (Rosemont) district.—A total of 29,188 tons of ore was produced in the Helvetia district in 1945. The most important output was 24,604 tons of high-silica low-grade copper ore shipped to smelters from the Helvetia and Mohawk properties near Sahuarita. The rest of the district output was mainly 2,030 tons of copper ore from the Bulldozer mine, 1,112 tons of copper ore from the Rosemont mine, 848 tons of copper ore from the Newman mine, and 395 tons of zinc-lead ore from the Daylight mine; all of these properties were worked by lessees.

Old Hat district (Oracle).—Mining and milling of copper ore at the Geeseman mine south of Oracle, by the Control Mines Co., were continuous throughout the year; about 10,600 tons of copper ore were treated by flotation, and 979 tons of similar ore were shipped direct to the copper smelter at Hayden.

Pima (Sierritas, Papago, Twin Buttes) district.—Approximately 99,100 tons of ore were treated in 1945 in the 400-ton flotation mill of the Eagle-Picher Mining & Smelting Co. near Sahuarita. Of this total, 39,816 tons averaging 3.81 ounces of silver to the ton and 0.83 percent copper, 6.07 percent lead, and 12.07 percent zinc came from the

San Xavier group at Sahuarita operated by the Eagle-Picher Mining & Smelting Co.; 49,598 tons were zinc-lead ore from the Copper Queen mine of the Phelps Dodge Corp. at Bisbee, and 9,698 tons were various classes of ore from custom shippers. The San Xavier mine also produced 456 tons of lead ore, which was shipped direct to the smelter at El Paso, Tex. The remainder of the district output was 2,603 tons of zinc ore produced from the Contention and San Xavier Extension mines and treated in the Eagle-Picher mill.

Roskruge and Waterman (Silver Hill) district.—During the first 6 months of 1945 the old Silver Hill mine was operated by A. R. Byrd, Jr., and the last 6 months by the Arizona Copper Bell Mining Co.; a total of 5,655 tons of copper-silver ore was shipped to smelters in Arizona and Texas.

Silver Bell district.—Byrd & Dillard operated the Arizona-Indiana mine a few months in 1945 and shipped 366 tons of silver-lead ore to the smelter at El Paso. The rest of the district output was 207 tons of copper ore shipped from the old Silver Bell mine 40 miles northwest of Tucson.

PINAL COUNTY

Bunker Hill district (Copper Creek).—The only output in the Bunker Hill district in 1945 was 58 tons of copper ore produced from the Magma Chief mine near Sombrero Butte.

Martinez Canyon district.—A total of 555 tons of lead ore was produced in 1945 from the Silver Bell-Martinez group by the California Steel Products Co.; 340 tons were treated in the company 50-ton gravity-concentration mill, and 215 tons were shipped direct to a smelter.

Mineral Creek district (Ray).—Difficulty in obtaining a sufficient supply of underground miners at the Ray property of the Kennecott Copper Corp. resulted in a further drop in output of copper ore; in 1945 the output was 1,366,473 tons compared with 1,893,683 tons in 1944. The crude ore, averaging 1.277 percent copper, was hauled by rail 26 miles to the company 10,000-ton flotation mill at Hayden, where it was reduced to 62,947 tons of copper concentrate; the concentrate was smelted in the American Smelting & Refining Co. plant also at Hayden. In addition, 6,082 tons of copper precipitates were shipped to the Kennecott Copper Corp. smelter at Hurley, N. Mex. The rest of the district output was 7,798 tons of oxide copper ore produced from an open pit at the Copper Butte property and shipped direct to the smelter at Hayden.

Mineral Hill district.—W. O. Kay developed the Sunset property near Price throughout the year and shipped 55 tons of copper ore to a smelter; 43 tons of similar ore was produced from the Blackwater claim.

Old Hat district (Oracle).—The Mammoth-St. Anthony property at Tiger, one of the most important producers of zinc-lead ore in Arizona, was operated continuously in 1945 by the Mammoth-St. Anthony, Ltd. During the year the company treated 76,075 tons of ore, averaging 0.01 ounce of gold and 1.50 ounces of silver to the ton, 0.69 percent copper, 7.73 percent lead, and 9.11 percent zinc, in its 350-ton combined gravity and flotation mill. The lead concentrate (7,721 tons) and the zinc concentrate (10,144 tons) were shipped to smelters in

Texas. The property ranked second in production of lead in Arizona in 1945 and third in zinc. Three tons of gold ore produced from the Last Chance claim were treated by amalgamation. No ore was produced in 1945 from the San Manuel property south of Tiger, owned by the Magma Copper Co., but according to the company annual report for 1945, exploration of the property continued throughout the year; 38 churn-drill holes have been completed, and drilling is continuing on 7 others. A total of 39,311 feet has been drilled, and mineralization has been proved in an area 1,000 feet wide by 4,000 feet long, with the 2 ends and 1 side still open for extension. An estimate of tonnage and grade of ore based on drill-hole data without adding anything for extensions beyond boundaries as defined by completed holes shows a total of 83,900,000 tons of mixed oxide and sulfide ore averaging 0.79 percent copper and containing small (undetermined) quantities of gold, silver, and molybdenum.

Pioneer district (*Superior*).—Mining operations at the Magma mine, one of the most important producers of gold, silver, copper, and zinc in Arizona, were seriously affected in 1945 by the shortage of underground labor; the output of copper ore and zinc-copper ore dropped from 305,262 tons in 1944 to 177,712 tons in 1945. The labor shortage became so acute that the company ceased production of zinc-copper ore in July. During the year 106,249 tons of copper ore and 45,749 tons of zinc-copper ore were treated in the company 850-ton concentrator, and 25,714 tons of crude copper ore along with 34,498 tons of copper concentrates recovered from copper ore and 3,422 tons of copper concentrates recovered from zinc-copper ore were sent to the company 450-ton smelter at Superior. The zinc concentrates (5,140 tons) were shipped to Amarillo, Tex.

According to the company printed annual report for 1945, the net metal produced from Magma ore and concentrates was 5,406 ounces of gold, 210,228 ounces of silver, 16,791,415 pounds of copper, and 4,337,864 pounds of zinc. The average net cost of producing copper after deduction of gold, silver, and zinc concentrate values was 13.70 cents a pound in 1945 compared with 12.48 cents in 1944. The increased cost resulted largely from a decreased production of gold, silver, copper, and zinc. The labor situation in 1945 was worse than in 1944; the number of men on the underground pay roll reached a low point in the third quarter of the year, being less than one-half the number required for necessary development and full production. Available labor has improved as compared with the low point, but the pay roll still had fewer men at the beginning of 1946 than at the beginning of 1945; however, the mine was operated continuously throughout the year. Copper ore was mined between the 4,000 level and the 3,400 level; the bulk of the tonnage came from the 4,000- and 3,800-level stopes. Remnants of ore were removed above the 3,600 level, and at the end of the year all known ore above the 3,600 level on the west side of the mine had been removed. Zinc-copper ore was mined from the 2,250 level to the 1,500 level on the east side of the mine from January 1 to July 3, when operations ceased because it was more economical to put all of the available men on copper production than to divide them between copper and zinc stopes. Plans are under way and designing has begun for a new crushing plant and mill to replace the one now in use. The present mill is obsolete, and deterioration has progressed so far that replacement is necessary. Development in 1945 comprised 1,156 feet of raising, 784 feet of drifting, and 302 feet of crosscutting.

The remainder of the district output was principally 1,758 tons of siliceous silver ore produced from the Reymert mine by Reymert Lease and shipped to the Magma smelter.

Summit district.—Lessees continued operating the American mine 12 miles west of Miami and shipped 360 tons of copper ore to the Magma smelter at Superior.

SANTA CRUZ COUNTY

Harshaw district.—As usual the most important output in the Harshaw district in 1945 was zinc-lead-silver ore produced from the Trench-Flux-January groups, 12 miles south of Patagonia, by the American Smelting & Refining Co.; however, the output of ore was less than in 1944. The company reported that 44,437 tons of zinc-lead-silver ore produced from the Trench-Flux-January groups and 9,711 tons of zinc-lead-copper ore received from custom shippers in the Patagonia district were treated in its 200-ton flotation mill. The total ore yielded 2,692 tons of lead-copper concentrates and 4,769 tons of zinc concentrates. The rest of the district output was 110 tons of oxide silver-lead ore produced from the Hardshell mine by the American Smelting & Refining Co.

Oro Blanco district (Ruby).—Hugo W. Miller operated under lease the Montana mine near Ruby throughout the year, shipped 223 tons of silver-lead ore to the smelter at El Paso, and hauled 191 tons of zinc-lead ore to a custom mill near Sahuarita.

Palmetto district.—In 1945, as in 1944, the output of the Palmetto district was all sulfide copper ore (5,251 tons) produced from the old Three "R" mine near Patagonia by Pierce & Bird and shipped direct to the smelter at El Paso.

Patagonia (Duquesne) district.—A total of 10,019 tons of ore was produced from 5 mines in the Patagonia district in 1945; 9,711 tons of it were zinc-lead-copper ore produced from the Duquesne and Pride of the West properties and treated by flotation in the Trench mill near Patagonia, owned by the American Smelting & Refining Co. The Duquesne property was operated by A. R. Byrd, Jr., and the Pride of the West mine by the Humphrey Mining Co.; the latter mine was sold late in the year to C. O. Byrd. The rest of the district output was 308 tons of copper ore shipped direct to a smelter from the Arizona, Buena Vista, and Line Boy properties.

Tyndall district.—Lessees operated the Jefferson and Royal Blue mines in 1945 and produced a total of 1,673 tons of ore; 1,068 tons were lead ore from the Jefferson mine, and 410 tons were zinc-lead-copper ore and 195 tons copper ore from the Royal Blue mine. Gold-silver ore (4 tons) was produced from the Riggs claim.

YAVAPAI COUNTY

Agua Fria district.—In 1945, as in 1944, all the output in the Agua Fria district was high-silica copper ore shipped direct to a smelter; 3,062 tons were produced from the Binghampton mine 6 miles east of Mayer, 3,159 tons from the Stoddard mine, and 185 tons from the Yaller Kid claim.

Big Bug district.—In 1945 the Big Bug district ranked second in zinc production in the State and fourth in gold, silver, and lead production. The Iron King mine of the Shattuck Denn Mining Corp. was by far the principal producer; it was operated continuously throughout the year, and 116,486 tons of zinc-lead-iron ore (98,988 tons in 1944) were treated in the company 375-ton flotation mill. In addition, 800 tons of siliceous gold-silver ore were shipped direct to a smelter. The mill treated a total of 120,211 tons of ore (including 3,725 tons of custom ores) in 1945, which yielded 7,436 tons of lead concentrate, 12,546 tons of zinc concentrate, and 4,852 tons of iron concentrate. According to the annual report of the Shattuck Denn Mining Corp. for 1945, underground mine developments at the Iron King property were favorable, and ore reserves were well-maintained in both quantity and grade. The rest of the district lode output was 12,000 tons of old copper tailings from the Humboldt tailing dump treated by flotation, 1,146 tons of copper ore from the Blue Bell mine shipped to the smelter at Clarkdale, 972 tons of zinc-lead-copper ore from the Hackberry mine treated in the Iron King custom mill, and 20 tons of gold-lead ore produced from the Snow Drift claim. The placer output was 492 ounces of gold and 45 ounces of silver; nearly all of it was recovered by sluicing at the Standard claim near Mayer.

Black Canyon district.—The output of the Black Canyon district in 1945 comprised 87 tons of gold ore produced from the Golden Turkey, Hooping Dasher, and Mineral Hill properties, 71 tons of zinc ore from the French Lilly mine, 13 tons of silver-lead ore from the Silver Cord mine, 10 tons of gold-silver ore from the Golden Belt mine, and 7 tons of silver ore from the Thunderbolt mine.

Bullard (*Pierce*) *district*.—Mining of siliceous gold-copper ore at the Bullard mine near Aguila was carried on only 1 month (January) in 1945, resulting in a marked decrease in the district production of gold, silver, and copper.

Cherry Creek district.—The Volcano mine was operated a short time in 1945, and 14 tons of siliceous gold ore were shipped to a smelter.

Copper Basin district.—Approximately 12,515 tons of ore were produced in the Copper Basin district in 1945 compared with 15,638 tons in 1944; 9,842 tons were low-grade siliceous copper ore shipped direct to a smelter from the Commercial mine near Skull Valley, and 2,673 tons were zinc ore from the Boston-Arizona mine hauled to the Iron King flotation mill at Humboldt for treatment.

Eureka district (*Bagdad*).—Copper ore mined from the Bagdad property of the Bagdad Copper Corp. continued to be the most important production in the Eureka district. The company reported that 618,766 tons of ore, averaging 0.915 percent copper to the ton, were treated in 1945 in its 2,500-ton flotation plant and that 11,337 tons of copper concentrates were shipped to the smelter at El Paso. In addition, 2,371 tons of copper ore were shipped direct to a smelter, and 13 tons of molybdenum concentrates were produced. The remainder of the district output was principally 1,953 tons of zinc oxide ore and 199 tons of zinc-lead sulfide ore shipped to various reduction works in Utah and Nevada from the Copper King mine, 935 tons of gold-silver ore shipped direct to a smelter from the Hillside mine, and 775 tons of copper ore shipped to a smelter from the Eureka mine.

Hassayampa (Groom Creek, Hassayampa River, Senator, Prescott) district.—Small lots of ore and 3 ounces of placer gold were produced from various claims in the Hassayampa district in 1945. The largest output was 41 tons of gold ore from the Sacramento claim.

Pine Grove district (Crown King).—About 850 tons of gold ore, containing some silver, copper, lead, and zinc, were produced in 1945 from the Gladiator-War Eagle group near Crown King by the Gladiator Mining Co. Most (750 tons) of the ore was treated in a 50-ton flotation mill, and the remainder was shipped direct to a smelter. The rest of the district output was mainly 339 tons of copper ore produced from the Springfield mine. The Western Gold Mines, Inc., did considerable work in 1945 in cleaning out the old 1,300-foot tunnel at the Wildflower mine, erecting new mine surface plants, and reconditioning the 75-ton flotation mill; however, no ore was treated during the year.

Squaw Peak district.—Copper-molybdenum ore (145 tons) was produced from the Squaw Peak mine in 1945 and treated in a 10-ton pilot flotation mill, which yielded 10 tons of copper concentrate and 2 tons of molybdenum concentrate.

Tiger district.—Lessees continued to operate the Pilgrim claim near Crown King and shipped 266 tons of rich gold ore to the smelter at Clarkdale. Gold ore (41 tons) was shipped also from the old Boaz mine.

Verde district (Jerome).—The United Verde mine, one of the most important producers of gold, silver, and copper in Arizona, was operated continuously in 1945 by the Phelps Dodge Corp.; however, the output of copper ore declined from 503,620 tons in 1944 to 377,217 tons in 1945. Of the ore mined in 1945 from the property, 202,288 tons were siliceous copper ore shipped to the corporation smelter at Clarkdale, and 174,929 tons were similar ore treated in the corporation 2,100-ton concentrator. In addition, 278 tons of copper precipitates were shipped to the smelter.

According to the annual report of the corporation for 1945, continued depletion of the underground ore reserves caused a marked decline in the rate of copper production. Stoping operations, which were on a reduced scale, were confined to the lower levels of the mine. Exploration and development totaled 23,680 feet, comprising 600 feet of drifting, 536 feet of raising, 130 feet of calyx drilling, and 22,414 feet of diamond drilling. Of the total footage driven, 85 feet of drifting and 19,835 feet of diamond drilling were for the purpose of exploring the deep levels of the mine off the No. 8 shaft; however, no important additions were made to the ore reserves.

The rest of the district output was 14,433 tons of siliceous copper ore shipped to the smelter at Clarkdale from the Dundee-Arizona, Florentia, and Verde properties and 645 tons of siliceous gold-silver ore shipped to a smelter from the Iron King-Equator group. Leasing operations at the latter property ceased in March, resulting from the exhaustion of all known ore.

Walker district.—Lessees operated the Alturas, Alturas Extension, Emma, and Hot Spot properties in 1945 and shipped a total of 110 tons of rich gold-lead ore to a smelter. The remainder of the district output was principally 54 tons of zinc-lead ore produced from the New Strike mine.

Weaver district (*Octave*).—The output of the Weaver district in 1945 comprised 147 tons of gold ore shipped from the Octave waste dump, 8 tons of old tailings (gold) shipped from the Monica dump, 1 ton of gold ore produced from the Piper claim, and 5 ounces of placer gold recovered from gravel at Rich Hill.

White Picacho district.—Three properties in the White Picacho district in Yavapai County produced a total of 155 tons of ore in 1945; 119 tons were gold ore shipped to a smelter from the Robertson and Young properties, and 36 tons were silver-lead ore produced from the Independence mine.

YUMA COUNTY

Castle Dome district.—The Arizona Lead Co. mined about 12,250 tons of oxidized lead ore from the De Luce group in 1945. Of the total ore mined, 12,200 tons were treated in the company 150-ton mill, equipped with jigs and tables, and 50 tons were shipped to a smelter at El Paso. The milling ore yielded 794 tons of concentrate containing 2 ounces of gold, 14,769 ounces of silver, 813,846 pounds of lead, and a little copper. The company suspended mining lead ore in December and began a diamond-drilling program to investigate gold-bearing ore bodies. The rest of the district output was all lead ore (511 tons) produced mainly from the Sonora mine.

Cienega district.—Three mines in the Cienega district produced a total of 174 tons of ore in 1945. Nearly all (169 tons) of it was highly siliceous gold-copper ore produced from the Empire-Arizona property, 12 miles east of Parker, by Strategic Metal Mines.

Ellsworth (*Harqua Hala*) *district.*—The Liberator Mines Co. continued in 1945 to mine low-grade gold-copper ore from the Yuma Copper mine near Vicksburg; 3,617 tons of ore, containing 109 ounces of gold, 990 ounces of silver, and 125,855 pounds of copper, were shipped to smelters in Arizona.

Plomosa district.—A total of 447 tons of ore was produced in the Plomosa district in 1945; most of it (428 tons) was siliceous silver ore shipped to a smelter by lessees working the R. & A. mine.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN CALIFORNIA

(MINE REPORT)

By Alfred L. Ransome and Burton H. Marliave

SUMMARY OUTLINE

SUMMARY

California gold production in 1945 was 26 percent above the record low level of 1944, an increase for the first year since 1940. Silver production was 27 percent higher than in 1944, making 1945 the second year of increase. Lead production was the largest in quantity and value since the record output of 1917; and zinc was the largest in quantity since 1926 and in value in the history of mining in California. Copper production, on the other hand, dropped 49 percent below the 1944 output, and for this reason the total value of the five metals ($11,152,081) increased only 2 percent above 1944. The upward trend in gold was largely the result of termination of War Production Board Limitation Order L–208 on July 1, 1945, the immediate effect of which was an accelerated output from placer-mining operations. The increase in production of silver, lead, and zinc and the marked decline in copper were largely the result of the activity of a few mines and did not reflect a general change in the industry. A continuation of higher wages, rising prices of supplies and equipment and difficulties of obtaining them, high taxes, the fixed prices for gold and silver, and the countrywide economic uncertainty following the end of the war were factors that prevented a more widespread recovery of mining in California, particularly with regard to gold.

Comparing 1945 with 1944, gold increased 26 percent and silver 27 percent both in quantity and value; copper decreased 49 percent both in quantity and value; lead increased 27 percent in quantity and 37 percent in value; and zinc increased 17 percent in quantity and 18 percent in value. The total value of the five metals was 2 percent more than in 1944; of the total value, gold represented 47 percent, zinc 20 percent, copper 16 percent, lead 11 percent, and silver 6 percent.

The counties of the State, arranged by value of the five metals, were in decidedly different order in 1945 from 1944 and other recent years; 1945 was the beginning of a transition period from wartime emphasis on base-metal output that raised certain counties to leadership, back to a peacetime basis, which includes the unrestricted production of gold. In earlier years the counties at the top of the list were invariably big gold producers, and in 1945 the influence of increased gold output was already beginning to show. Inyo County, second on the list in 1944, first in 1943, and seventh in 1942, was the leader again in 1945 owing almost entirely to lead production, which represented over one-half the total value of its metal output; the greater portion of lead as well as substantial quantities of silver, copper, and zinc came from the Darwin group of mines, Coso district. Shasta County, sixth on the list in 1944, was second in 1945. Production of copper and zinc ores was higher, and the output of copper and zinc in relation to that in other counties was greater by virtue of shut-downs of large copper and zinc mines elsewhere. Nevada County, third on the list in 1945 (ninth in 1944), was well on its way to regaining the leading position held in 1942, largely from an increase in output of gold ore. Sacramento County was fourth on the list in 1945, an advance from seventh place in 1944 owing entirely to the expansion of connected-bucket dredging operations. Calaveras County, fourth on the list in 1944, dropped back to fifth place in 1945; operations along the Mother Lode and in the East Belt remained suspended, and termination of activity at the Keystone copper mine, Copperopolis district, in July offset the gain in output of zinc and copper from the Eagle Shawmut Mine's Penn mine, Campo Seco district. Other counties of the leading 10, listed in order of total value of output, were: Yuba County (largely from connected-bucket dredging), Mariposa County (largely from zinc ore), Butte County (largely from zinc ore), Siskiyou County (largely from copper from the Gray Eagle Copper Co. Dakin mine, Klamath River district, which shut down in June), and Stanislaus County (entirely from connected-bucket dredging). Of the 29 counties producing, these 10 furnished 88 percent of the total value of the five metals produced in the State during the year.

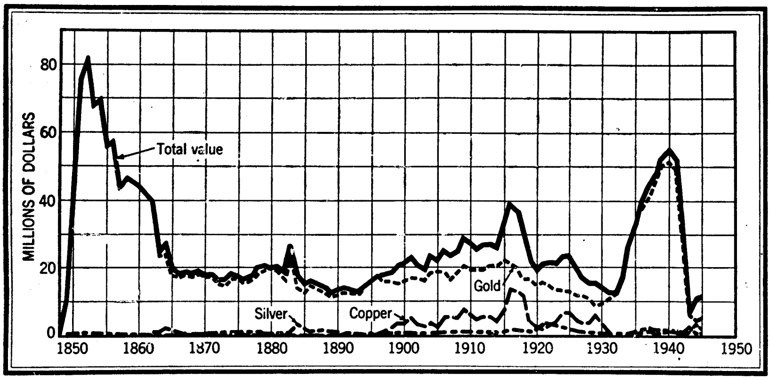

FIGURE 1.—Value of mine production of gold, silver, and copper and total value of gold, silver, copper, lead, and zinc in California, 1848–1945. The value of lead and zinc has exceeded $1,000,000 in only a few years.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of god, silver, copper, lead, and zinc in California, 1941–45, and total, 1848–1945, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	835	724	4,280,185	1,408,793	$49,307,755	2,154,188	$1,531,867
1942	434	428	2,503,198	847,997	29,679,895	1,450,440	1,031,424
1943	139	82	739,956	148,328	5,191,480	609,075	433,120
1944	109	66	925,953	117,373	4,108,055	778,936	553,910
1945	87	99	717,969	147,938	5,177,830	986,798	701,723
1848–1945			(2)	101,524,395	2,255,457,477	106,857,437	86,056,080

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	7,886,000	$930,548	6,928,000	$394,896	880,000	$66,000	$52,231,066
1942	2,116,000	256,036	10,302,000	690,234	1,226,000	114,018	31,771,607
1943	17,524,000	2,278,120	11,640,000	873,000	3,712,000	400,896	9,176,616
1944	25,442,000	3,434,670	11,364,000	909,120	16,910,000	1,927,740	10,933,495
1945	12,946,000	1,747,710	14,448,000	1,242,528	19,846,000	2,282,290	11,152,081
1848–1945	[3] 621,584	199,920,104	[3] 149,729	18,479,803	[3] 73,330	14,180,408	2,574,093,872

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figures not available.
[3] Short tons.

Gold production at placer mines in California, 1941–45, by classes of mines and by methods of recovery, and total, 1848–1945 [1]

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average per cubic yard
Surface placers:						
Gravel mechanically handled:						
Connected-bucket dredges:						
1941	37	47	135,757,000	418,282	$14,639,870	$0.108
1942	30	44	106,543,000	310,937	10,882,795	.102
1943	8	10	17,880,000	66,999	2,344,965	.131
1944	5	7	21,524,000	64,925	2,272,375	.106
1945	16	26	30,738,000	88,318	3,091,130	.101
Dragline dredges:						
1941	234	112	45,579,000	225,019	7,875,665	.173
1942	122	79	24,526,000	117,906	4,126,710	.168
1943	3	3	3,180,000	14,196	496,860	.156
1944	2	2	1,213,000	6,241	218,435	.180
1945	6	6	414,400	1,242	43,470	.105
Becker-Hopkins dredges:						
1941	3	2	52,000	244	8,540	.164
1942	1		5,000	23	805	.161
1943–45						
Suction dredges: [3]						
1941	17	17	357,000	1,763	61,705	.173
1942	18	15	278,000	1,419	49,665	.179
1943–45						
Nonfloating washing plants: [4]						
1941	85	76	5,656,000	28,703	1,004,605	.178
1942	46	40	1,637,000	10,044	351,540	.215
1943	16	15	547,000	2,997	104,895	.192
1944	14	14	223,000	1,210	42,350	.190
1945	8	8	519,300	974	34,090	.066
Gravel hydraulically handled:						
Hydraulic:						
1941	79		2,886,000	10,145	355,075	.123
1942	45		1,980,000	6,106	213,710	.108
1943	12		366,000	1,723	60,305	.165
1944	13		212,000	838	29,330	.138
1945	17		282,300	922	32,270	.114
Small-scale hand methods: [5]						
Wet:						
1941	182		1,599,700	29,040	1,016,400	.635
1942	119		1,152,900	16,079	562,765	.488
1943	29		118,460	2,536	88,760	.749
1944	25		96,000	1,408	49,280	.513
1945	45		88,300	1,526	53,410	.605
Dry:						
1941	13		7,300	220	7,700	1.055
1942	7		1,100	73	2,555	2.323
1943	1		40	4	140	3.500
1944	(6)		200	3	105	.525
1945						
Underground placers:						
Drift:						
1941	74		90,000	4,597	160,895	1.788
1942	45		22,000	2,339	81,865	3.721
1943	13		4,500	970	33,950	7.544
1944	7		3,800	424	14,840	3.905
1945	7		2,700	498	17,430	6.456

See footnotes at end of table.

Gold production at placer mines in California, 1941–45, by classes of mines and by methods of recovery, and total, 1848–1945 [1]—Continued

Class and method	Mines producing [2]	Washing plants (dredges)	Material treated (cubic yards)	Gold recovered		
				Fine ounces	Value	Average per cubic yard
Grand total placer:						
1941	724		191,984,000	718,013	$25,130,455	$0.131
1942	[7] 428		136,145,000	464,926	16,272,410	.120
1943	82		22,096,000	89,425	3,129,875	.142
1944	66		23,272,000	75,049	2,626,715	.113
1945	99		32,045,000	93,480	3,271,800	.102
1848–1945 [1]			(8)	65,263,022	1,419,943,416	(8)

[1] For historic data by years see Minerals Yearbook, Review of 1940, p. 219.
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Includes all placer operations using suction pump for delivering gravel to floating washing plant except those producing less than 100 ounces of gold which are included under "Small-scale hand methods."
[4] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."
[5] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms, dip boxes, pans, rockers, dry washers, etc.
[6] From property not classed as a "mine."
[7] A mine using more than 1 method of recovery is counted but once in arriving at total for all methods.
[8] Complete data not available.

Gold.—An uninterrupted rise beginning in 1929 culminated in the production of $50,948,485 in gold in 1940, the largest value since 1856. In 1941, however, a reaction set in that gained headway in 1942. By January 1943, monthly production had sunk to 16,425 fine ounces, and until November 1945 it fluctuated between that figure and a low of 8,547 ounces established in February 1943. In 1945 the rescinding of WPB Limitation Order L–208 effective July 1 and the end of the Japanese phase of World War II on August 14 paved the way toward a marked increase in the production of gold. Monthly production in 1945, which remained within narrow limits during the first 8 months, showed an unmistakable trend upward commencing in September, and the monthly average for the year was 12,328 ounces compared with 9,781 ounces for 1944. The expected sharp gain did not materialize as rapidly as some had predicted owing to the many interrelated problems of reconversion plus the factors of rising costs, the difficulty of obtaining adequate labor and supplies, and the fixed price of gold. Placer mining accelerated rapidly, but lode gold mining, except for increased production at most properties already in operation, was slower in becoming reestablished, and many of the mines that were large producers before the war had not reopened by the end of 1945.

The monthly production figures since January 1937 through the war years have been discussed in detail in this chapter for 1944; however, because of the importance to the gold-mining industry of the termination of Order L–208, it is of interest to review briefly the course of gold production during the period centering about the months when the order was in effect. Monthly production of gold in California declined approximately 4 percent a month fairly regularly from January 1941 to May 1942, when the downward trend greatly accelerated and continued at about 16 percent a month to December 1942. Strangely, the period when WPB Order L–208 was becoming effective did not mark a substantial change in the trend. Apparently economic forces were curtailing gold production so rapidly in 1942 that exercise of Federal authority was not needed to accomplish a most drastic curtailment of gold mining in California.

Mine production of gold in California, 1937–45, by months, in fine ounces, in terms of recovered metal

Month	1937	1938	1939	1940	1941	1942	1943	1944	1945
January	83, 964	96, 469	106, 362	128, 127	129, 894	101, 698	16, 425	10, 216	10, 126
February	82, 357	94, 368	112, 497	112, 536	123, 735	91, 945	8, 547	8, 772	9, 922
March	89, 116	100, 029	116, 171	120, 596	120, 462	95, 344	14, 440	10, 111	11, 786
April	102, 217	107, 512	113, 587	119, 063	129, 664	92, 652	12, 461	9, 673	10, 285
May	104, 850	106, 103	124, 682	127, 467	121, 231	87, 037	13, 424	10, 013	10, 850
June	86, 449	103, 027	122, 306	130, 111	118, 462	84, 016	15, 552	9, 972	8, 970
July	113, 251	112, 240	122, 672	91, 678	120, 089	70, 002	12, 910	9, 774	10, 159
August	95, 756	111, 680	113, 185	110, 666	118, 379	64, 615	12, 759	9, 177	9, 983
September	96, 777	116, 532	122, 506	105, 443	108, 430	56, 108	10, 501	8, 917	13, 457
October	107, 971	113, 174	125, 713	124, 085	111, 658	56, 502	11, 411	10, 892	15, 704
November	104, 580	120, 339	128, 273	136, 181	101, 591	27, 919	10, 074	9, 638	18, 430
December	107, 290	129, 656	127, 310	149, 718	105, 198	20, 159	9, 824	10, 218	18, 266
	1, 174, 578	1, 311, 129	1, 435, 264	1, 455, 671	1, 408, 793	847, 997	148, 328	117, 373	147, 938

Twenty-five leading gold-producing mines in California in 1945, in order of output

Rank	Mine	District	County	Rank in 1944	Operator	Source of gold
1	Yuba Unit	Yuba River	Yuba	1	Yuba Consolidated Gold Fields.	Dredge.
2	Natomas Co	Folsom	Sacramento	2	Natomas Co	Do.
3	Idaho Maryland and Brunswick.	Grass Valley-Nevada City.	Nevada	4	Idaho Maryland Mines Corporation.	Gold ore.
4	Empire Star group	do	do	3	Empire Star Mines Co., Ltd.	Do.
5	Lower Comanche dredge.	Camanche	San Joaquin	18	Gold Hill Dredging Co.	Dredge.
6	Tuolumne gold dredge.	La Grange	Stanislaus	7	Tuolumne Gold Dredging Corporation.	Do.
7	Eagle Shawmut	Mother Lode	Tuolumne	6	Eagle Shawmut Mine.	Gold ore.
8	Original Sixteen to One.	Alleghany	Sierra	11	Original Sixteen to One Mine, Inc.	Do.
9	Capital dredge	Folsom	Sacramento	(1)	Capital Dredging Co.	Dredge.
10	Penn	Campo Seco	Calaveras	16	Eagle Shawmut Mine.	Zinc ore.
11	La Grange dredge No. 4.	La Grange	Stanislaus	(1)	La Grange Gold Dredging Co.	Dredge.
12	Ancho and Erie groups.	Washington	Nevada	(1)	Ancho-Erie Mining Co.	Gold ore.
13	French Gulch Placer.	French Gulch	Shasta	(1)	French Gulch Dredging Co.	Dredge.
14	Kister	Oroville	Butte	(1)	Gold Hill Dredging Co.	Do.
15	Butte Unit	do	do	(1)	Yuba Consolidated Gold Fields.	Do.
16	Blue Moon	Hunter Valley	Mariposa	12	Red Cloud Mines, Inc.	Zinc ore.
17	Merced Dredge No. 1.	Snelling	Merced	(1)	Merced Dredging Co.	Dredge.
18	Thurman dredge	Igo	Shasta	(1)	Thurman Gold Dredging Co.	Do.
19	Brush Creek	Downieville	Sierra	86	Alfred L. Merritt	Gold ore.
20	Mount Gaines	Hunter Valley	Mariposa	10	Mount Gaines Mining Co.	Do.
21	Junction City	Junction City	Trinity	(1)	Junction City Mining Co.	Dredge.
22	Columbia No. 2	Resting Springs	Inyo	13	Shoshone Mines, Inc., and Finley Co.	Lead ore.
23	Siskiyou Unit	Callahan	Siskiyou	(1)	Yuba Consolidated Gold Fields.	Dredge.
24	Yreka gold dredge	Klamath River	do	(1)	Yreka Gold Dredging Co.	Do.
25	Lancha Plana	Folsom	Sacramento	(1)	Lancha Plana Gold Dredging Co.	Do.

[1] Not operated in 1944.

FIGURE 2.—Mine production of gold in California, 1937–45, by months, in terms of recovered gold.

The 25 leading gold-producing mines in California in 1945, listed in the foregoing table, yielded 92 percent of the total gold output of the State; the leading 5 mines produced 65 percent and the leading 10 mines 77 percent.

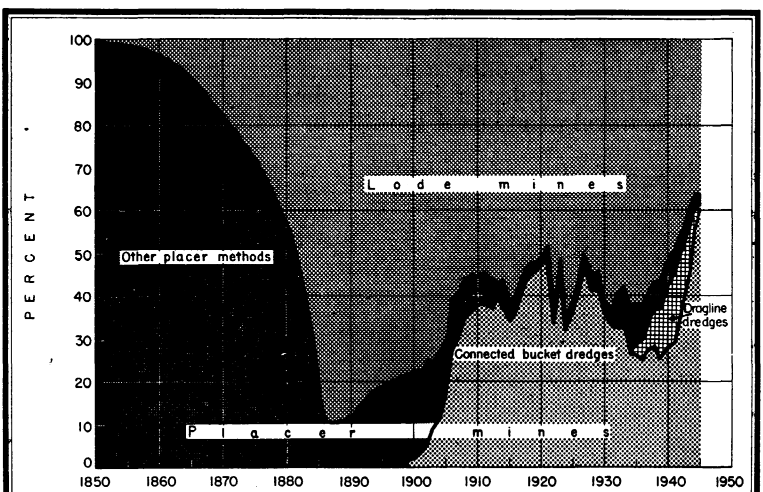

FIGURE 3.—Percentage of total California gold produced at lode and placer mines and by various method of placer mining, 1850–1945.

Silver.—Most of the silver output in California in 1945 was more localized than that of the gold; the 10 leading silver-producing mines listed in the following table yielded 95 percent of the State total recoverable silver in that year, and the 3 leading mines yielded 72 percent. Of the 10 leading silver-producing mines, 9 derived their silver from argentiferous base-metal ores and 1 from gold ore.

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Ten leading silver-producing mines in California in 1945, in order of output

Rank	Mine	District	County	Rank in 1944	Operator	Source of silver
1	Darwin group	Coso	Inyo	1	Darwin Mines (Arthur J. Theis, trustee) and Anaconda Mining Co.	Zinc-lead ore.
2	Blue Moon	Hunter Valley	Mariposa	2	Red Cloud Mines, Inc.	Zinc ore.
3	Hornet	Flat Creek	Shasta	4	The Mountain Copper Co., Ltd.	Zinc-copper.
4	Penn	Campo Seco	Calaveras	7	Eagle Shawmut Mine	Zinc ore.
5	Columbia No. 2	Resting Springs	Inyo	3	Shoshone Mines, Inc., and Finley Co.	Lead ore.
6	Modoc	Coso	do	(1)	L. D. Foreman & Co.	Do.
7	Mohawk	Clark Mountain.	San Bernardino.	17	Dunton-Ray & Greenwood	Zinc-lead ore.
8	Big Bend	Yankee Hill	Butte	14	Hoefling Bros	Zinc ore.
9	Newton	Ione	Amador	27	Winston Copper Co.	Copper ore.
10	Idaho Maryland and Brunswick.	Grass Valley-Nevada City.	Nevada	29	Idaho Maryland Mines Corporation.	Gold ore.

[1] Not operated in 1944.

Silver production by months in 1945, as presented in the following table, shows an uninterrupted but gradual decline during the first 6 months, a spurt upward in July followed by a drop to the low point of 49,695 fine ounces in August, and a subsequent rapid rise during the remaining 4 months. The entire background for the trends in production is closely allied to the operation of the Darwin group of mines, Coso district, Inyo County. Purchased by the Anaconda Copper Mining Co. August 1, the Darwin property was energetically developed; although production during August was low, the rapid increase in output is reflected in the unchecked rise in total production for the State during the last 4 months of 1945.

Mine production of silver, copper, lead, and zinc by months in 1945, in terms of recovered metal

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	76,226	827	563	713
February	72,068	570	544	673
March	69,922	694	517	845
April	69,333	477	407	834
May	66,169	883	441	766
June	63,546	814	358	910
July	72,829	245	464	756
August	49,695	329	449	877
September	71,282	306	687	885
October	107,948	412	735	841
November	124,613	422	868	955
December	143,167	494	1,191	868
	986,798	6,473	7,224	9,923

Copper.—Copper production in California in 1945 dropped 49 percent below that for 1944 owing to the closing of two of the State's largest wartime copper producers, the Dakin or Gray Eagle mine (Gray Eagle Copper Co.), Klamath River district, Siskiyou County, and the Keystone mine (Keystone Copper Corp.), Copperopolis district, Calaveras County, after producing during the first half of 1945. The monthly copper-production figures given in the preceding table show an erratic fluctuation during the first half of 1945 followed by a marked drop in July, which reflects the shutdown of the two major producers. Although the trend was upward during the latter half of the year, output of copper did not recover, the monthly average production in the last half being only 52 percent of that for the first 6 months. The following eight properties (operators in parentheses), listed in order of output and each producing over 100,000 pounds, supplied 92 percent of the State total, and the first three 65 percent: Hornet mine, Flat Creek district, Shasta County (The Mountain Copper Co., Ltd.); Dakin mine, Klamath River district, Siskiyou County (Gray Eagle Copper Co.); Newton mine, Ione district, Amador County (Winston Copper Co.); Keystone mine, Copperopolis district, Calaveras County (Keystone Copper Corp.); Penn mine, Campo Seco district, Calaveras County (Eagle Shawmut Mine); Big Bend mine, Yankee Hill district, Butte County (Hoefling Bros.); Blue Moon mine, Hunter Valley district, Mariposa County (Red Cloud Mines, Inc.); and the Darwin group, Coso district, Inyo County (Darwin Mines and Anaconda Copper Mining Co., operating at different periods in 1945).

Lead.—Lead production in California in 1945 advanced 27 percent over 1944 and was the largest in quantity and value since the record output of 1917. A study of the monthly lead-production figures given in the preceding table shows a variable trend, the background for which is closely allied to operation of the Darwin group of mines explained in the paragraph on silver. The three leading producers contributed 88 percent of the State total in 1945. The following seven properties (operators in parentheses), listed in order of lead output and each producing over 100,000 pounds, furnished 97 percent of the State total: The Darwin group, Coso district, Inyo County (Darwin Mines and Anaconda Copper Mining Co., operating at different periods in 1945); Columbia No. 2 mine, Resting Springs district, Inyo County (Shoshone Mines, Inc., and Finley Co., operating at different periods in 1945); Modoc mine, Modoc district, Inyo County (L. D. Foreman & Co.); Mohawk mine, Clark Mountain district, San Bernardino County (Dunton-Ray & Greenwood); Blue Moon mine, Hunter Valley district, Mariposa County (Red Cloud Mines, Inc.); Penn mine, Campo Seco district, Calaveras County (Eagle Shawmut Mine); and Big Four mine, Wild Rose district, Inyo County (Silas Ness).

Zinc.—Zinc production in California in 1945 was 17 percent above that for 1944 and the largest in quantity since 1926 and in value in the history of mining in California. Most of the output came from mines brought into production since 1942. The following seven properties (operators in parentheses), listed in order of zinc output and each producing over 100,000 pounds in 1945, contributed 99 percent of the State total: Blue Moon mine, Hunter Valley district, Mariposa County (Red Cloud Mines, Inc.); Penn mine, Campo Seco district, Calaveras County (Eagle Shawmut Mine); Hornet mine, Flat Creek district, Shasta County (The Mountain Copper Co., Ltd.); Big Bend mine, Yankee Hill district, Butte County (Hoefling Bros.); the Darwin group, Coso district, Inyo County (Darwin Mines and Anaconda Copper Mining Co., operating at different periods in 1945); Mohawk mine, Clark Mountain district, San Bernardino County (Dunton-Ray

& Greenwood); and Afterthought mine, North Cow Creek district, Shasta County (Jordan & Glennan). Monthly production of zinc in 1945 was erratic, but an upward trend was discernible. Production reached the high point of 955 short tons in November but decreased in December. The decline can be attributed in part to permanent shutdown of the Blue Moon mine on November 15.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in California in 1945, by counties, in terms of recovered metals

County	Mines producing [1]		Gold					
			Lode		Placer		Total	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	5	1	352	$12,320	124	$4,340	476	$16,660
Butte	2	6	588	20,580	4,292	150,220	4,880	170,800
Calaveras	8	2	2,397	83,895	85	2,975	2,482	86,870
Eldorado	3	3	211	7,385	465	16,275	676	23,660
Fresno	-	1	-	-	117	4,095	117	4,095
Humboldt	-	2	-	-	51	1,785	51	1,785
Inyo	13	-	1,844	64,540	-	-	1,844	64,540
Kern	6	2	577	20,195	337	11,795	914	31,990
Los Angeles	1	1	51	1,785	36	1,260	87	3,045
Madera	1	-	1	35	-	-	1	35
Mariposa	8	2	3,253	113,855	17	595	3,270	114,450
Merced	-	2	-	-	1,479	51,765	1,479	51,765
Modoc	1	-	10	350	-	-	10	350
Nevada	4	7	32,905	1,151,675	258	9,030	33,163	1,160,705
Orange	1	-	13	455	-	-	13	455
Placer	1	9	53	1,855	1,159	40,565	1,212	42,420
Plumas	4	-	28	980	-	-	28	980
Sacramento	-	7	-	-	32,851	1,149,785	32,851	1,149,785
San Bernardino	12	1	989	34,615	71	2,485	1,060	37,100
San Francisco	-	(2)	-	-	12	420	12	420
San Joaquin	-	2	-	-	7,343	257,005	7,343	257,005
Santa Cruz	1	-	2	70	-	-	2	70
Shasta	4	4	1,245	43,575	3,549	124,215	4,794	167,790
Sierra	3	7	4,750	166,250	98	3,430	4,848	169,680
Siskiyou	4	13	483	16,905	2,184	76,440	2,667	93,345
Stanislaus	-	2	-	-	7,544	264,040	7,544	264,040
Trinity	2	18	19	665	1,805	63,175	1,824	63,840
Tuolumne	3	1	4,687	164,045	9	315	4,696	164,360
Yuba	-	6	-	-	29,594	1,035,790	29,594	1,035,790
	87	99	54,458	1,906,030	93,480	3,271,800	147,938	5,177,830
Total, 1944	109	66	42,324	1,481,340	75,049	2,626,715	117,373	4,108,055

See footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1945, by counties, in terms of recovered metals—Continued

County	Silver					
	Lode		Placer		Total	
	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Amador	12,486	$8,879	31	$22	12,517	$8,901
Butte	18,758	13,339	349	248	19,107	13,587
Calaveras	65,247	46,398	18	13	65,265	46,411
Eldorado	1,056	751	56	40	1,112	791
Fresno	-----	-----	17	12	17	12
Humboldt	-----	-----	7	5	7	5
Inyo	637,881	453,604	-----	-----	637,881	453,604
Kern	481	342	62	44	543	386
Los Angeles	415	295	7	5	422	300
Madera	83	59	-----	-----	83	59
Mariposa	96,521	68,637	3	2	96,524	68,639
Merced	-----	-----	139	99	139	99
Modoc	7	5	-----	-----	7	5
Nevada	12,257	8,716	31	22	12,288	8,738
Orange	2,655	1,888	-----	-----	2,655	1,888
Placer	14	10	148	105	162	115
Plumas	8	6	-----	-----	8	6
Sacramento	-----	-----	1,509	1,073	1,509	1,073
San Bernardino	33,007	23,472	14	10	33,021	23,482
San Francisco	-----	-----	-----	-----	-----	-----
San Joaquin	-----	-----	754	536	754	536
Santa Cruz	1	1	-----	-----	1	1
Shasta	93,984	66,833	478	340	94,462	67,173
Sierra	834	593	12	9	846	602
Siskiyou	2,242	1,594	288	205	2,530	1,799
Stanislaus	-----	-----	516	366	516	366
Trinity	4	3	176	125	180	128
Tuolumne	2,807	1,996	1	1	2,808	1,997
Yuba	-----	-----	1,434	1,020	1,434	1,020
	980,748	697,421	6,050	4,302	986,798	701,723
Total, 1944	774,405	550,688	4,531	3,222	778,936	553,910

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Amador	1,654,000	$223,290	-----	-----	-----	-----	$248,851
Butte	390,000	52,650	48,000	$4,128	2,502,000	$287,730	528,895
Calaveras	3,462,000	467,370	214,000	18,404	4,270,000	491,050	1,110,105
Eldorado	96,000	12,960	-----	-----	-----	-----	37,411
Fresno	-----	-----	-----	-----	-----	-----	4,107
Humboldt	-----	-----	-----	-----	-----	-----	1,790
Inyo	204,000	27,540	13,098,000	1,126,428	2,054,000	236,210	1,908,322
Kern	-----	-----	8,000	688	14,000	1,610	34,674
Los Angeles	2,000	270	10,000	860	-----	-----	4,475
Madera	22,000	2,970	-----	-----	-----	-----	3,064
Mariposa	180,000	24,300	236,000	20,296	6,622,000	761,530	989,215
Merced	-----	-----	-----	-----	-----	-----	51,864
Modoc	-----	-----	-----	-----	-----	-----	355
Nevada	-----	-----	-----	-----	-----	-----	1,169,443
Orange	-----	-----	8,000	688	26,000	2,990	6,021
Placer	-----	-----	-----	-----	-----	-----	42,535
Plumas	-----	-----	-----	-----	-----	-----	986
Sacramento	-----	-----	-----	-----	-----	-----	1,150,858
San Bernardino	114,000	15,390	770,000	66,220	574,000	66,010	208,202
San Francisco	-----	-----	-----	-----	-----	-----	420
San Joaquin	-----	-----	-----	-----	-----	-----	257,541
Santa Cruz	-----	-----	-----	-----	-----	-----	71
Shasta	3,752,000	506,520	56,000	4,816	3,784,000	435,160	1,181,459
Sierra	-----	-----	-----	-----	-----	-----	170,282
Siskiyou	3,052,000	412,020	-----	-----	-----	-----	507,164
Stanislaus	-----	-----	-----	-----	-----	-----	264,406
Trinity	-----	-----	-----	-----	-----	-----	63,968
Tuolumne	18,000	2,430	-----	-----	-----	-----	168,787
Yuba	-----	-----	-----	-----	-----	-----	1,036,810
	12,946,000	1,747,710	14,448,000	1,242,528	19,846,000	2,282,290	11,152,081
Total, 1944	25,442,000	3,434,670	11,364,000	909,120	16,910,000	1,927,740	10,933,495

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Output from property not classed as a "mine."

MINING INDUSTRY

The tonnage of material from lode mines in California treated in 1945 decreased 22 percent compared with 1944, but the yardage at placer mines increased 38 percent. The output of lode gold advanced 29 percent and placer gold 25 percent. Placer gold accounted for 63 percent of the total gold output of the State, compared with 64 percent in 1944. The decrease in base-metal ore production was greater than the increase in gold-ore output. The average recoverable gold content of gravels decreased 10 percent.

Dredges of the connected-bucket type washed 96 percent of the total gravel mined in the State in 1945 and recovered 94 percent of the total placer gold; the value and quantity of gold produced by connected-bucket dredges were the largest since 1942. Dragline dredges washed 1 percent of the total gravel mined and recovered 1 percent of the placer gold, the lowest point reached by dragline dredging in either yardage washed or gold recovered since 1933, the year in which the method was first used in California. All other placer-mining methods, except nonfloating washing plants, showed an increase in quantity of gold recovered; material handled was less in the cases of drift and small-scale hand methods. No Becker-Hopkins dredges or suction dredges have been reported in production since 1942. Nonfloating washing plants to which gravel was delivered by mechanical means (dragline excavators, power shovels, slackline excavators, trucks, and bulldozers) treated more gravel and recovered less gold than in 1944.

Hydraulic mining began to increase in 1945 following termination of WPB Order L–208, and gold production from small-scale hand methods showed an 8-percent increase. The number of drift mines operating in 1945 was the same as in 1944, but the quantity and value of the gold produced were greater.

Consumption of quicksilver at California placer mines that indicated the use of this metal totaled 2,123 pounds in 1945. The following quantities of gold were recovered to the pound of quicksilver used in 1945 (1944 figures in parentheses): Connected-bucket dredging, 42 ounces (63); dragline dredging, 5 ounces (46); nonfloating washing plants with mechanical gravel handling, 15 ounces (45); hydraulicking, 22 ounces (40); and small-scale hand operations, 5 ounces (9).

ORE CLASSIFICATION

Of the 717,969 tons of ore (including 220,303 tons of old tailings) sold or treated in 1945, 43 percent was copper, 24 percent gold, almost 16 percent zinc-copper, 8 percent zinc, almost 5 percent zinc-lead, and almost 4 percent lead. Gold-silver and silver ores comprised less than a third of 1 percent.

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in California in 1945, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	170,909	1,744	46,993	21,235	45,000	2,400	----------
Dry and siliceous gold-silver ore	39	451	35	1,261	3,100	28,200	----------
Dry and siliceous silver ore	82	---------	2	1,388	----------	2,700	----------
	171,030	2,195	47,030	23,884	48,100	33,300	----------
Copper ore	104,326	207,000	796	19,354	[1] 7,098,800	----------	----------
Lead ore	14,945	11,108	1,462	106,792	99,600	4,359,200	16,600
Zinc ore	60,105	---------	4,270	176,164	1,785,600	495,400	13,394,000
Zinc-copper	112,861	---------	446	88,377	3,696,600	29,500	3,478,600
Zinc-lead	34,399	---------	454	566,177	217,300	9,530,600	2,956,800
Total, lode mines	497,666	220,303	54,458	980,748	[1] 12,946,000	14,448,000	19,846,000
Total, placers	---------	---------	93,480	6,050	----------	----------	----------
	497,666	220,303	147,938	986,798	[1] 12,946,000	14,448,000	19,846,000
Total, 1944	[2] 691,844	234,109	[3] 117,373	[3] 778,936	[3,4] 25,442,000	11,364,000	16,910,000

[1] Includes 22,000 pounds from precipitates.
[2] Excludes tungsten ore.
[3] Includes metal recovered from tungsten ore.
[4] Includes 61,100 pounds from precipitates.

METALLURGIC INDUSTRY

During 1945, 67 percent of the total ore and old tailings handled was treated at concentrating mills, 23 percent was treated at amalgamation and cyanidation mills, and 10 percent was shipped for direct smelting. Smelters also received 55,838 tons of flotation concentrates and 14 tons of gravity concentrates from California mine operators. Comparing 1945 with 1944, material treated at cyanidation mills remained virtually unchanged, the quantity of material amalgamated increased 31 percent, and the quantity of crude ore and old tailings smelted increased 13 percent. The quantities of ore and old tailings concentrated decreased 35 percent.

Because of unusual conditions in the California gold industry in 1944 and 1945, quicksilver and cyanide consumption data at mills were not representative of the industry.

The Selby lead smelter of the American Smelting & Refining Co. was the only custom plant that treated gold, silver, copper, or lead ores in California in 1945. Some ore and concentrates were shipped to out-of-State custom mills and smelters, but most of the ore produced in the State was treated in company-owned metallurgical plants at the mines.

Mine production of metals in California in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore and old tailings amalgamated	164,003	27,671	4,875	----------	----------	----------
Ore, old tailings, and concentrates cyanided	27,580	11,992	6,587	----------	----------	----------
Concentrates smelted:						
Flotation	55,838	11,419	308,062	10,950,700	1,054,500	18,160,900
Gravity	14	57	16	----------	----------	----------
Ore and old tailings smelted	70,502	3,319	661,208	1,973,300	13,393,500	1,685,100
Precipitates	----------	----------	----------	22,000	----------	----------
Total, lode mines	----------	54,458	980,748	12,946,000	14,448,000	19,846,000
Total, placers	----------	93,480	6,050	----------	----------	----------
	----------	147,938	986,798	12,946,000	14,448,000	19,846,000
Total, 1944	----------	117,373	778,936	25,442,000	11,364,000	16,910,000

Mine production of metal from amalgamation and cyanidation mills (with or without concentration equipment) in California in 1945, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal				
	Ore [1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Amador	491	--------	95	37	13	53	12	--------	--------
Butte	50	--------	48	7	--------	--------	--------	--------	--------
Calaveras	224	--------	125	66	12	49	55	--------	--------
Eldorado	20	--------	17	8	--------	--------	--------	--------	--------
Inyo	39	4	4	3	1	4	4	--------	--------
Kern	355	--------	178	81	--------	--------	--------	--------	--------
Mariposa	2,140	--------	1,273	332	38	417	140	--------	400
Nevada	94,910	--------	20,326	3,323	84	696	65	--------	--------
Placer	166	--------	53	14	--------	--------	--------	--------	--------
Plumas	156	--------	17	5	--------	--------	--------	--------	--------
Santa Cruz	2	--------	2	1	--------	--------	--------	--------	--------
Shasta	1,190	--------	531	104	28	228	56	--------	--------
Sierra	2,387	--------	4,750	834	--------	--------	--------	--------	--------
Siskiyou	11	--------	17	3	--------	--------	--------	--------	--------
Trinity	10	12	19	4	--------	--------	--------	--------	--------
Tuolumne	61,836	--------	216	53	1,926	4,471	2,754	18,000	--------
	163,987	16	27,671	4,875	2,102	5,918	3,086	18,000	400
Total, 1944	125,158	35	14,752	2,722	2,222	6,657	3,158	14,000	200

Mine production of metal from amalgamation and cyanidation mills (with or without concentration equipment) in California in 1945, by types of mills and by counties, in terms of recovered metals—Continued

CYANIDATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal				
	Ore [1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Inyo	380		19	3					
Kern	3,368	368	399	262					
Nevada	23,464		11,574	6,322					
	27,212	368	11,992	6,587					
Total, 1944	24,313	3,335	9,242	12,791	64	356	115		2,000
Grand total:									
1945	191,199	384	39,663	11,462	2,102	5,918	3,086	18,000	400
1944	149,471	3,370	23,994	15,513	2,286	7,013	3,273	14,000	2,200

[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.

Mine production of metals from concentrating mills in California in 1945, by counties, in terms of recovered metals

County	Material treated		Concentrates smelted and recovered metal					
	Ore	Old tailings	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Butte	10,580		3,315	540	18,751	390,000	48,000	2,502,000
Calaveras	71,895	207,000	13,774	2,220	65,126	3,462,000	214,000	4,270,000
Eldorado	3,270		215	194	1,048	96,000		
Inyo	8,564		1,432	114	26,985	11,100	498,200	993,500
Kern	174		28		138		8,000	14,000
Mariposa	21,389		6,641	1,553	95,392	179,600	233,400	6,622,000
Orange	145		68	13	2,655		8,000	26,000
Shasta	114,131		20,575	458	92,658	3,742,000	44,500	3,733,400
Siskiyou	42,200		7,702	466	2,239	3,052,000		
	272,348	207,000	53,750	5,558	304,992	10,932,700	1,054,100	18,160,900
Total, 1944	513,630	220,282	[1] 84,667	[1] 7,877	[1] 400,633	[1] 24,349,200	812,700	15,357,100

[1] Includes concentrates and metals from tungsten ore not included in material treated.

Gross metal content of concentrates produced from ores mined in California in 1945, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	2,110	6,032	3,144	25,057	819	
Copper	33,800	3,202	128,557	10,747,249	337,257	1,387,704
Lead	745	126	23,592	54,313	435,392	145,016
Lead-copper	488	738	55,651	144,444	199,613	156,389
Zinc	18,709	1,378	97,134	384,148	239,664	19,211,374
	55,852	11,476	308,078	11,355,211	1,212,745	20,900,483
Total, 1944	86,953	14,890	403,906	25,290,077	1,985,649	17,841,807

Mine production of metals from California concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	13	53	12			
Butte	3,315	540	18,751	390,000	48,000	2,502,000
Calaveras	13,786	2,269	65,181	3,462,000	214,000	4,270,000
Eldorado	215	194	1,048	96,000		
Inyo	1,433	118	26,989	11,100	498,200	993,500
Kern	28		138		8,000	14,000
Mariposa	6,679	1,970	95,532	179,600	233,800	6,622,000
Nevada	84	696	65			
Orange	68	13	2,655		8,000	26,000
Shasta	20,603	686	92,714	3,742,000	44,500	3,733,400
Siskiyou	7,702	466	2,239	3,052,000		
Tuolumne	1,926	4,471	2,754	18,000		
	55,852	11,476	308,078	10,950,700	1,054,500	18,160,900
Total, 1944	86,953	14,890	403,906	24,363,200	1,814,900	15,357,100

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	2,110	6,032	3,144	18,000	400	
Copper	33,800	3,202	128,557	10,413,800	212,700	139,000
Lead	745	126	23,592	46,300	426,700	90,500
Lead-copper	488	738	55,651	108,600	194,400	
Zinc	18,709	1,378	97,134	364,000	220,300	17,931,400
	55,852	11,476	308,078	10,950,700	1,054,500	18,160,900

Gross metal content of California crude ore and old tailings shipped to smelters in 1945, by classes of material

Class of ore	Material shipped		Gross metal content				
	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	2,997	1,360	1,298	6,521	31,364	187	
Dry gold-silver	39	451	35	1,261	4,077	28,917	
Dry silver	109		2	1,496	811	5,458	
Copper	15,247		207	13,020	[1] 1,739,094		
Lead	12,945	11,108	1,374	105,632	132,595	4,438,616	17,582
Zinc-copper	151		4	1,160	11,754	11,736	69,907
Zinc-lead	26,095		399	532,118	188,696	9,275,578	2,237,198
	57,583	12,919	3,319	661,208	[1] 2,108,391	13,760,492	2,324,687
Total, 1944	52,046	10,457	3,440	354,986	[2] 1,157,233	9,844,969	3,916,403

[1] Includes 22,000 pounds contained in precipitates.
[2] Includes 61,100 pounds contained in precipitates.

Mine production of metals from California crude ore and old tailings shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Material shipped		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Amador	14, 876	274	204	12, 437	1, 654, 000		
Calaveras	9		3				
Inyo	33, 370	11, 559	1, 703	610, 886	192, 900	12, 599, 800	1, 060, 500
Los Angeles	17		51	415	2, 000	10, 000	
Madera			1	83	[1] 22, 000		
Mariposa	39		10	657	400	2, 200	
Modoc	3		10	7			
Nevada		1, 086	309	2, 547			
Plumas	4		11	3			
San Bernardino	9, 107		989	33, 007	114, 000	770, 000	574, 000
Shasta	158		28	1, 166	10, 000	11, 500	50, 600
	57, 583	12, 919	3, 319	661, 208	[1] 1, 995, 300	13, 393, 500	1, 685, 100
Total, 1944	52, 046	10, 457	3, 440	354, 986	[2] 1, 078, 800	9, 549, 100	1, 552, 900

BY CLASSES OF MATERIAL

	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
Dry gold	2, 997	1, 360	1, 298	6, 521	26, 400		
Dry gold-silver	39	451	35	1, 261	3, 100	28, 200	
Dry silver	109		2	1, 496	600	4, 700	
Copper	15, 247		207	13, 020	[1] 1, 704, 800		
Lead	12, 945	11, 108	1, 374	105, 632	98, 400	4, 324, 500	12, 800
Zinc-copper	151		4	1, 160	10, 000	11, 500	50, 600
Zinc-lead	26, 095		399	532, 118	152, 000	9, 024, 600	1, 621, 700
	57, 583	12, 919	3, 319	661, 208	[1] 1, 995, 300	13, 393, 500	1, 685, 100

[1] Includes 22,000 pounds from precipitates.
[2] Includes 61,100 pounds from precipitates.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in California in 1945, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Amador County:											
Ione	1	(4)	14,875	133	2	135	12,119	1,653,800			$236,606
Mother Lode [5]	4	1	766	219	122	341	398	200			12,245
Butte County:											
Butte Creek	1	1	50	48	40	88	14				3,090
Cherokee		(4)			10	10	1				351
Merimac		1			25	25	2				876
Oroville		4			4,217	4,217	339				147,836
Yankee Hill	1		10,580	540		540	18,751	390,000	48,000	2,502,000	376,742
Calaveras County:											
Campo Seco	1		27,895	2,157		2,157	61,900	1,212,000	214,000	4,268,000	792,357
Copperopolis	2		250,759	43		43	3,105	2,246,000			306,923
East Belt [6]	2	1	10	5	52	57	11				2,003
Jenny Lind	1		221	167		167	121				5,931
Mother Lode [5]	1	1	2	5	33	38	7				1,335
West Belt [7]	1		241	20		20	121	4,000		2,000	1,556
Eldorado County:											
Cosumnes River		1			389	389	45				13,647
East Belt [6]	(8)	1	(8)	(8)	10	[9] 10	[9] 1				[9] 351
Mother Lode [5]	1	1	3,120	80	66	146	1,000	96,000			18,781
Fresno: Friant		1			117	117	17				4,107
Humboldt: Orleans		2			51	51	7				1,790
Inyo County:											
Cerro Gordo	1		560				557	1,800	63,000		6,057
Coso	4		27,157	379		379	532,103	104,000	8,705,200	1,992,600	1,383,485
Fish Springs	1		8	2		2					70
Modoc	2		10,801	41		41	42,973	71,600	1,723,800		189,907
Sherman	1		380	19		19	3				667
Slate Range	1		2,653	135		135	2,129	4,600	94,000	16,600	16,853
Union	1		188	205		205	1,724	400	21,500		10,304
Wild Rose	1		288	3		3	647	400	105,500	44,800	14,844
Kern County:											
Amelie	1		174				138		8,000	14,000	2,396
China Grade		1			330	330	59				11,592
Mojave	1		1,800	223		223	208				7,953
Randsburg [10]	3	1	2,141	257	7	264	79				9,296
Los Angeles County:											
San Gabriel		1			36	36	7				1,265
Unallocated	1		17	51		51	415	2,000	10,000		3,210

Madera County: Daulton	1			1		1	83	[11] 22,000			3,064
Mariposa County:											
Colorado		1			4	4					140
East Belt [6]	1		84	302		302	38				10,597
Hunter Valley	4		23,465	2,940		2,940	96,479	180,000	236,000	6,622,000	977,633
Mother Lode [5]	3	1	19	11	13	24	7				845
Modoc County: High Grade	1		3	10		10	7				355
Nevada County:											
Grass Valley-Nevada City	3	3	88,986	30,982	82	31,064	12,077				1,095,828
Washington	1	(4)	7,010	1,923	2	1,925	194				67,513
Orange County: Santa Rosa	1		145	13		13	2,655		8,000	26,000	6,021
Placer County:											
Auburn		(4)			88	88	10				3,087
Dutch Flat		1			12	12	3				422
Foresthill		1			25	25	3				877
Iowa Hill	1	(4)	166	53	15	68	17				2,392
Last Chance		4			119	119	11				4,173
Lincoln		1			1	1					35
Michigan Bluff		(4)			14	14	1				491
Ophir		(4)			23	23	3				807
Undistributed		(4)			30	30	3				1,052
Plumas County:											
Johnsville	3		154	21		21	5				739
Lights Creek	1		6	7		7	3				247
Sacramento County: Folsom		7			32,851	32,851	1,509				1,150,858
San Bernardino County:											
Buckeye	1		2,724	844		844	3,521	17,000			34,339
Calico	2		137	3		3	996		51,500	6,600	6,001
Cima	1		272	47		47	806	22,800			5,296
Clark Mountain	1		5,473	42		42	27,199	57,800	705,500	550,600	152,607
Exchequer	1		224	12		12	86	9,200			1,723
Ivanpah	3		147	14		14	276	400	11,000	16,800	3,618
New York Mountains	1		27				108	600	2,000		330
Randsburg [10]		1			71	71	14				2,495
Whipple Mountains	1		3	1		1	3				37
Undistributed	1		100	26		26	12	6,200			1,756
San Francisco County: San Francisco		(4)			12	12					420
Santa Cruz: Bonny Doone	1		2	2		2	1				71
Shasta County:											
Flat Creek	1	(4)	112,710	442	47	489	87,223	3,686,600	18,000	3,428,000	972,599
French Gulch	2	(8)	1,197	783	(8)	[12] 783	[12] 166				[12] 27,523
North Cow Creek	1		1,572	20		20	6,601	65,400	38,000	356,000	58,431
Old Diggings		1			2	2					70
Redding		1			64	64	10				2,247
Slate Creek		(4)			48	48	6				1,684
Sierra County:											
Alleghany	(8)	2	(8)	(8)	15	[9] 15	[9] 5				[9] 529
Pike		1			11	11	3				387
Poker Flat		1			19	19	1				666
Washington		1			9	9	3				317

Footnotes at end of table.

Mine production of gold, silver, copper, lead, and zinc in California in 1945, by counties and districts, in terms of recovered metals [1]—Continued

County and district [1]	Mines producing [2]		Ore and old tailings	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Siskiyou County:											
Deadwood	------	(4)	------	------	6	6	1	------	------	------	$211
Humbug	(8)	1	(8)	(8)	5	[9] 5	[9] 1	------	------	------	[9] 176
Klamath River	3	(8)	42,210	472	(8)	[12] 472	[12] 2,240	3,052,000	------	------	[12] 430,133
Liberty	------	4	------	------	191	191	28	------	------	------	6,704
Salmon River	------	1	------	------	9	9	1	------	------	------	316
Scott Bar	------	1	------	------	113	113	21	------	------	------	3,970
Stanislaus County: La Grange	------	2	------	------	7,544	7,544	516	------	------	------	264,406
Trinity County:											
Big Bar	------	1	------	------	125	125	14	------	------	------	4,385
Cinnabar	------	2	------	------	17	17	------	------	------	------	595
Coffee Creek	------	1	------	------	7	7	1	------	------	------	246
Crow Creek	------	1	------	------	2	2	------	------	------	------	70
Hayfork	1	------	10	15	------	15	4	------	------	------	528
Helena	------	(4)	------	------	5	5	1	------	------	------	176
Junction City	1	4	12	4	1,492	1,496	142	------	------	------	52,461
Lewiston	------	2	------	------	28	28	3	------	------	------	982
New River	------	1	------	------	5	5	2	------	------	------	176
Trinity Center	------	1	------	------	15	15	3	------	------	------	527
Weaverville	------	4	------	------	107	107	10	------	------	------	3,752
Tuolumne County:											
East Belt [6]	2	1	55	118	1	119	27	------	------	------	4,184
Mother Lode [5]	1	(4)	61,781	4,569	8	4,577	2,781	18,000	------	------	164,603
Yuba County:											
Camptonville	------	4	------	------	81	81	7	------	------	------	2,840
Smartville	------	(4)	------	------	3	3	------	------	------	------	105
Other districts [13]	8	23	14,589	6,049	44,632	50,681	61,846	21,200	2,385,000	------	2,025,787
Total California	87	99	717,969	54,458	93,480	147,938	986,798	[11] 12,946,000	14,448,000	19,846,000	11,152,081

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 13 and their output included under "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 980,748 ounces from lode mines and 6,050 ounces from placers.

[4] Output from property not classed as a "mine."

[5] Mother Lode district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.

[6] East Belt district lies in Amador, Calaveras, Eldorado, Mariposa, and Tuolumne Counties.

[7] West Belt district lies in Calaveras and Eldorado Counties.

[8] Included under "Other districts."

[9] Exclusive of lode output which is included under "Other districts."

[10] Randsburg district lies in Kern and San Bernardino Counties.

[11] Includes 22,000 pounds from precipitates.

[12] Exclusive of placer output which is included under "Other districts."

[13] Includes following: East Belt district (lode) in Eldorado County; Resting Springs district in Inyo County; Green Mountain district in Kern County; Snelling district in Merced County; French Corral and North Bloomfield districts in Nevada County; Butcher Ranch district in Placer County; Camanche district in San Joaquin County; French Gulch district (placer) and Igo district in Shasta County; Alleghany district (lode) and Downieville district in Sierra County; Callahan and Greenhorn districts, and Humbug district (lode), Klamath River district (placer), and Quartz Valley district, Siskiyou County; Salyer district, Trinity County; and Yuba River district, Yuba County.

AMADOR COUNTY

Ione district.—The Winston Copper Co. operated the Newton mine throughout 1945 and shipped 14,875 tons of copper smelting ore, from which 133 ounces of gold, 12,119 ounces of silver, and 1,653,800 pounds of copper were recovered.

Mother Lode district.—The Nevada Wabash Mining Co. operated the Nevada Wabash mine during part of 1945 and treated the ore by amalgamation. Tom Kloczko shipped old tailings from the Garibaldi Ranch mine to a smelter and recovered a small quantity of gold and silver. The Argonaut Mining Co., Ltd., recovered a small quantity of gold from a mill clean-up at the idle Argonaut mine.

BUTTE COUNTY

Butte Creek district.—The Wyoming mine operated during most of 1945, a small quantity of gold being recovered by amalgamation.

Oroville district.—The Yuba Consolidated Gold Fields placed in operation on October 6 its Butte unit, a connected-bucket electric dredge equipped with 84 9-cubic foot buckets; the unit was 1 of 4 dredges which closed down October 15, 1942. The Gold Hill Dredging Co. placed its Kister dredge in operation August 1 on the east side of the Feather River about 7 miles south of Oroville. The electrically operated dredge has 74 9-cubic foot buckets. The Morris Ravine Mining Co. produced 1,000 cubic yards of gravel at the Morris Ravine drift mine and recovered 430 ounces of gold and 40 ounces of silver.

Yankee Hill district.—Hoefling Bros. operated the Big Bend mine from January 1 to December 28, 1945, and trucked 10,580 tons of zinc ore to the Surcease mill; 751 tons of copper concentrate (containing 360 ounces of gold, 11,751 ounces of silver, 316,171 pounds of copper, 33,663 pounds of lead, and 227,920 pounds of zinc) and 2,564 tons of zinc concentrate (containing 180 ounces of gold, 7,000 ounces of silver, 120,080 pounds of copper, 16,820 pounds of lead, and 2,624,881 pounds of zinc) were recovered by flotation and shipped to smelters. The mine shut down on December 28.

CALAVERAS COUNTY

Campo Seco district.—Eagle Shawmut Mine operated the Penn mine throughout 1945 and shipped 27,895 tons of zinc ore to the company mill at the Eagle Shawmut mine near Jacksonville; 2,577 tons of copper concentrate (containing 1,871 ounces of gold, 41,814 ounces of silver, 1,208,025 pounds of copper, and 293,160 pounds of lead) and 4,702 tons of zinc concentrate (containing 286 ounces of gold, 20,086 ounces of silver, 29,881 pounds of copper, 42,777 pounds of lead, and 4,742,830 pounds of zinc) were recovered by flotation and shipped to smelters.

Copperopolis district.—The Keystone mine was operated during the first half of 1945 by the Keystone Copper Corp., the Corporation ranked third as a producer of copper in the State in 1945. The Pacific Mining Co. operated a flotation plant on old tailings at the Union mine during the first half of 1945.

Jenny Lind district.—Allen W. Doe, lessee, amalgamated gold ore produced at the Royal mine.

Mother Lode district.—A small quantity of gold was recovered at the Calaveras Crystal drift mine on McSorley's Ranch.

West Belt district.—G. Ivan Smith worked the Quail Hill mine for a short period in 1945; zinc ore was shipped to a concentrator smelter.

ELDORADO COUNTY

Cosumnes River district.—Hoosier Gulch Placers operated a dragline dredge (boat No. 2) from October 17 to December 6, 1945. The operation ranked first among placers and second in total production of gold in the county.

East Belt district.—E. C. Ogle operated the Cooley drift mine northeast of Georgetown and recovered 10 ounces of gold from 500 cubic yards of gravel. Cosumnes Mines, Inc., operated the Cosumnes mine at Grizzley Flat during the last 5 months of 1945 under a program of rehabilitation and produced flotation gold concentrates which were shipped to a smelter. Columbus Sciaroni operated the Mount Hope mine and recovered 17 ounces of gold and 8 ounces of silver by amalgamation.

Mother Lode district.—Pioneer-Lilyanna Mines completed a 250-ton flotation mill in 1945 and produced 207 tons of copper concentrate (containing 80 ounces of gold, 990 ounces of silver, and 98,300 pounds of copper) from copper ore obtained as the result of development work; the concentrate was shipped to a smelter. A. L. McGuire conducted placer operations at Bacchi Ranch from August 1 to December 31, 1945.

FRESNO COUNTY

Friant district.—The Grant Service Rock Co., Consolidated, recovered 117 ounces of gold and 17 ounces of silver as a byproduct from preparing 178,967 tons of sand and gravel at its commercial gravel plant at Ball Ranch on the San Joaquin River.

HUMBOLDT COUNTY

Orleans district.—The Pearch hydraulic mine operated during the first 3 months of 1945; 12,000 cubic yards of material handled yielded 47 ounces of gold and 7 ounces of silver. A small dragline operating at the Red Cap mine from January 15 to March 1, 1945, recovered a few ounces of gold.

INYO COUNTY

Cerro Gordo district.—L. D. Foreman & Co. shipped material to a smelter from the Cerro Gordo old slag dump.

Coso district.—The Darwin group of mines, which includes the Defiance, Independence, Essex, Thompson, Lucky Jim, Lane, Promontory, and Columbia claims, was operated by Darwin Mines (Arthur J. Theis, trustee) from January 1 through July 31, 1945. On August 1 the Anaconda Copper Mining Co. purchased the property and for the remaining 5 months of the year production proceeded at an increasing rate. A total of 6,564 tons of zinc-lead ore was treated in the 125-ton bulk flotation mill on the property, and 409 tons of lead concentrate (containing 13 ounces of gold, 15,099 ounces of silver, 3,419 pounds of copper, 357,437 pounds of lead, and 81,724 pounds of zinc) and 951 tons of zinc concentrate (containing 13 ounces of gold, 10,726 ounces of silver, 7,434 pounds of copper, 122,097 pounds of lead, and 949,533 pounds of zinc) were shipped to smelters. In addition, 20,177 tons of zinc-lead ore containing 351 ounces of gold, 504,002 ounces of silver, 119,152 pounds of copper, 8,425,070 pounds of lead, and 1,383,815 pounds of zinc were shipped for direct smelting. L. D. Foreman & Co. shipped material to a smelter from the Last Chance old slag dump.

Modoc district.—L. D. Foreman & Co. shipped lead ore and old slag to a smelter from the Modoc property.

Resting Springs district.—The Columbia No. 2 mine was operated throughout 1945—January through May by Shoshone Mines, Inc., and June through December by the Finley Co.; lead ore was shipped to a smelter.

Slate Range district.—Damon & Damon worked the Gold Bottom and Ophir mines throughout 1945; 202 tons of lead ore (containing 22 ounces of gold, 365 ounces of silver, 871 pounds of copper, 34,228 pounds of lead, and 17,582 pounds of zinc) and 451 tons of gold-silver old tailings (containing 25 ounces of gold, 604 ounces of silver, 3,483 pounds of copper, and 26,669 pounds of lead) were shipped to smelters. The moving of the 150-ton concentration and flotation mill of the Mineral Reduction Co. from Benton Station and its reconstruction at the Ophir mine was completed in 1945; 2,000 tons of lead ore were milled, and the resulting 72 tons of lead concentrate (containing 88 ounces of gold, 1,160 ounces of silver, 1,341 pounds of copper, 35,371 pounds of lead, and 5,266 pounds of zinc) were shipped to a smelter.

Union district.—T. L. Bright shipped lead ore to a smelter from the Reward (Brown Monster) mine.

Wild Rose district.—Silas Ness shipped zinc-lead ore from the Big Four mine to a smelter.

KERN COUNTY

China Grade district.—The Kern Rock Co. recovered 330 ounces of gold and 59 ounces of silver as byproducts from its gravel-washing operation on Cottonwood creek.

Green Mountain district.—Mattie Moreland amalgamated ore from the Lone Star mine during an operating period from May to November 1945.

Mojave district.—Burton Bros., Inc., cyanided 1,800 tons of gold ore from the Tropico mine during the last 4 months of 1945 and recovered 223 ounces of gold and 208 ounces of silver.

Randsburg district.—The Butte Lode Mining Co. treated 1,568 tons of gold ore and 368 tons of old tailings by amalgamation and cyanidation and recovered 176 ounces of gold and 54 ounces of silver. Max Hess recovered a few ounces of gold by amalgamating 100 tons of ore from the Marie Rose group of claims during a short operating period in December. E. B. Atkinson did development work at the Sunshine mine during a 3-month period in 1945; and gold and silver were recovered by amalgamation from a small tonnage of gold ore produced.

717372—47——19

LOS ANGELES COUNTY

San Gabriel district.—The Consolidated Rock Products Co. recovered gold and silver as byproducts from the Largo No. 10 gravel-washing plant operated for the production of crushed rock, sand, and gravel for concrete aggregate.

MADERA COUNTY

Daulton district.—Ace H. Alexander, lessee, recovered copper cement from mine water pumped from the Daulton mine during 1945.

MARIPOSA COUNTY

East Belt district.—Schroeder, Odgers, & Schroeder worked the Schroeder group from January 1 to August 15, 1945, and amalgamated 84 tons of ore, from which 302 ounces of gold and 38 ounces of silver were recovered.

Hunter Valley district.—L. M. Brady, lessee, worked the B. A. B. mine during a short period in 1945 and shipped gold-silver ore to a smelter. Red Cloud Mines, Inc., an operating subsidiary of the Hecla Mining Co. of Wallace, Idaho, worked the Blue Moon mine from January 1 to November 15, 1945, on which date a major cave-in in the mine resulted in operations being closed down. During the period of operation, 21,389 tons of zinc ore treated in the company 200-ton flotation mill yielded 488 tons of copper-lead concentrate (containing 738 ounces of gold, 55,651 ounces of silver, 144,444 pounds of copper, 199,613 pounds of lead, and 156,389 pounds of zinc) and 6,153 tons of zinc concentrate (containing 815 ounces of gold, 39,741 ounces of silver, 74,692 pounds of copper, 42,484 pounds of lead, and 6,756,451 pounds of zinc), which were shipped to smelters. Roy F. Hollis recovered 9 ounces of gold and 5 ounces of silver from a 3-week clean-up of old mining equipment at the Jenny Lind mine. The Mount Gaines Mining Co. operated the Mount Gaines mine throughout the year and amalgamated 2,037 tons of ore from which were recovered bullion containing 951 ounces of gold and 285 ounces of silver and 38 tons of flotation concentrate containing 417 ounces of gold, 140 ounces of silver, and 400 pounds of lead.

Mother Lode district.—The A. J. Lode, Lucky Boy, and Specimen mines were worked during relatively short periods in 1945, small quantities of gold being recovered by amalgamation at each property.

MERCED COUNTY

Snelling district.—The Merced Dredging Co. resumed operation of its connected-bucket dredge with 60 9½-cubic-foot buckets on Merced River ¾ mile south of Snelling on July 15. The unit had been inoperative since October 13, 1942, as the result of WPB Limitation Order L–208. Dredging was halted on September 13, owing to an antidredging ordnance passed by the county board of supervisors; injunction proceedings by the company against the resoiling ordnance were taken, but the case had not had a court hearing by December 31. The Merced Sand & Gravel Co. recovered a small quantity of gold as a byproduct of its gravel-washing operation on the Merced River.

MODOC COUNTY

High Grade district.—Ed Benefiel worked the Klondyke mine for a short period late in 1945 and shipped a small quantity of gold ore to a smelter.

NEVADA COUNTY

Grass Valley-Nevada City district.—The Empire Star Mines Co., Ltd., operated the Empire Star group throughout 1945, and the Idaho Maryland Mines Corp. operated the Idaho Maryland and Brunswick properties all year. Both companies had been operating under a limited employment grant by the WPB since March 1944, and production had been curtailed far below that of prewar years. The expected increase in output following the end of WPB Limitation Order L–208 on July 1, 1945, failed to materialize, owing to the difficulty of obtaining labor. Ore from the Empire Star group was treated by amalgamation and cyanidation. Gold and silver from the Idaho Maryland and Brunswick properties was recovered by amalgamation, with subsequent cyanidation of concentrates produced from a 600-ton flotation plant. Jordan & Glennan shipped old tailings from an old chlorination plant near Nevada City; a substantial quantity of gold and silver was recovered.

Washington district.—The Ancho-Erie Mining Co., taking advantage of the end of WPB Limitation Order L–208, commenced operation of the Ancho and Erie groups on July 2, 1945, and produced continuously for the remainder of the year; 7,010 tons of gold ore were milled, from which 1,227 ounces of gold and 129 ounces of silver were recovered by amalgamation. In addition, 696 ounces of gold and 65 ounces of silver were recovered from 84 tons of flotation concentrates produced at the company 100-ton plant and shipped to the Empire Star plant at Grass Valley for treatment by cyanidation.

ORANGE COUNTY

Santa Rosa district.—The Blue Light Silver Mines Co. worked the Silverado mine throughout 1945 on a small scale; work was confined mostly to development. Zinc ore (145 tons) containing 15 ounces of gold, 2,928 ounces of silver, 696 pounds of copper, 9,076 pounds of lead, and 36,173 pounds of zinc was shipped to a concentrator smelter.

PLACER COUNTY

Butcher Ranch district.—The Golden Feather Dredging Co. operated an electric dragline excavator equipped with a 5-cubic yard bucket on the Middle Fork of the American River, about 8 miles northeast of Auburn, from September 9 through December 31, 1945. The equipment had been moved from its former location on the Feather River Channel at Oroville, Butte County, in 1944.

Iowa Hill district.—The Drummond Mining Co. worked the Drummond mine from January 1 to December 15, 1945. From the operation, which was limited largely to rehabilitation and development work, 166 tons of gold ore were produced from which 53 ounces of gold and 14 ounces of silver were recovered by amalgamation.

Last Chance district.—The Red Star Mining Co. operated the Red Star hydraulic mine at intervals during the first half of 1945.

SACRAMENTO COUNTY

Folsom district.—Recovery of gold as a byproduct of gravel-washing operations was reported by C. M. Craig at the Brighton Sand & Gravel, De Paso Rock Products, and Perkins Gravel plants and by the Fair Oaks Gravel Co. at its plant on the American River. At the last-named operation 199 ounces of gold and 15 ounces of silver were produced from 48,664 cubic yards of material handled. The Capital Dredging Co. resumed operation of its connected bucket electric dredge, equipped with 100 18-cubic foot buckets, on ground 5 miles south of Folsom on October 8, 1945; the dredge was one of two which ceased operation October 15, 1942, in compliance with WPB Limitation Order L–208. The Lancha Plana Gold Dredging Co. placed in operation its connected-bucket dredge No. 4 on the American River October 22. By December 31, 1945, the Natomas Co. had resumed operation of five of its fleet of seven electric connected-bucket dredges at and near Natoma. Two of the units worked throughout the year; and one was placed in operation August 28, one on October 9, and one on December 10. The number and size of buckets for all seven dredges in the fleet are: No. 1, 62 16-cubic foot; No. 4, 67 15-cubic foot; No. 5, 105 12-cubic foot; No. 6, 106 11-cubic foot; No. 7, 98 9-cubic foot; No. 8, 105 11-cubic foot; and No. 10, 83 15-cubic foot. All seven dredges were in operation until October 15, 1942.

SAN BERNARDINO COUNTY

Buckeye district.—Donald F. Love, lessee, shipped gold ore from the Roosevelt mine to smelters.

Calico district.—Zinc-lead ore was shipped to a smelter from the Burcham mine in 1945, and the New Sutherland Divide Mining Co. shipped lead ore from the New Sutherland Divide mine to a smelter.

Cima district.—Willis Loveless shipped copper ore from the New Trail mine to a smelter as the result of operations from May through July.

Clark Mountain district.—Dunton-Ray & Greenwood worked the Mohawk mine and shipped zinc-lead ore to a smelter.

Exchequer district.—The Dutch Oven Mining Co. worked the Von Trigger mine during a short period in the first half of 1945 and shipped gold ore to smelters.

Ivanpah district.—Edward Johnson shipped lead ore to a smelter from the Albermarle mine. James E. Boland shipped gold ore from the Beverley Glenn mine and zinc-lead ore from the Lady Luck mine to smelters.

New York Mountains district.—The California Sulphur Co. produced silver ore at the Sagamore mine.

Randsburg district.—Hoefling Bros. recovered 71 ounces of gold and 14 ounces of silver as the byproduct of a placer operation carried on during 1945, principally for scheelite, at the Spud Patch mine.

SAN JOAQUIN COUNTY

Comanche district.—The Gold Hill Dredging Co. operated its Lower Comanche connected-bucket dredge along the Mokelumne River throughout 1945; the dredge, which had 87 8½-cubic-foot buckets, was operated before July 1, 1945, under a special grant from the WPB, which permitted the company to operate one dredge. On November 21, 1945, the company placed its Upper Comanche connected-bucket dredge in operation. This electric dredge was equipped with 66 7¾-cubic-foot buckets.

SHASTA COUNTY

Flat Creek district.—The Mountain Copper Co. Ltd., mined zinc-copper ore from the Mattie ore body in the Hornet mine throughout 1945; 112,710 tons of ore were treated in the company 350-ton selective flotation mill, and 16,112 tons of copper concentrate (containing 382 ounces of gold, 68,658 ounces of silver, 3,670,113 pounds of copper, 10,434 pounds of lead, and 1,159,784 pounds of zinc) and 3,994 tons of zinc concentrate (containing 60 ounces of gold, 18,559 ounces of silver, 133,020 pounds of copper, 13,281 pounds of lead, and 3,808,397 pounds of zinc) were recovered and shipped to smelters.

French Gulch district.—The French Gulch Dredging Co. resumed operation of its connected-bucket dredge on Clear Creek on September 22, 1945, following a period of inactivity under WPB Limitation Order L–208. The electrically operated dredge was equipped with 76 4½-cubic-foot buckets. E. H. Blagrave shipped 7 tons of gold ore from the Hobo mine to a smelter, from which 24 ounces of gold and 6 ounces of silver were recovered. The St. Jude Mining Co. worked the St. Jude mine and treated gold ore by amalgamation and concentration; the concentrate was shipped to a smelter.

Igo district.—The Thurman Gold Dredging Co. operated its connected-bucket dredge (72 9-cubic-foot buckets) on Clear Creek from August 24 through December 31, 1945; the dredge had been idle since October 15, 1942.

North Cow Creek district.—Jordon & Glennan shipped zinc-copper ore to a smelter and zinc-lead ore to a concentrator smelter from the Afterthought mine in 1945; operations were limited to a short period in the latter half of the year.

SIERRA COUNTY

Alleghany district.—C. M. Hawkins, lessee, worked the American Hill and Pilgrim Annex mine of the American Hill Mining Co. intermittently during the latter part of 1945; 170 tons of gold ore were treated by amalgamation, from which 30 ounces of gold and 4 ounces of silver were recovered. The Original Sixteen to One Mine, Inc., operated all year, recovering a substantial quantity of gold and a lesser quantity of silver by amalgamation. Before Limitation Order L–208 was rescinded effective July 1, 1945, the mine operated on a limited basis under a grant issued by the WPB.

Downieville district.—C. L. Best produced a small quantity of gold from gravel mined at the Ruby drift mine as the result of maintenance work during 1945. Alfred L. Merritt, lessee, worked the Brush Creek mine intermittently in 1945; gold ore was treated by amalgamation.

SISKIYOU COUNTY

Callahan district.—Yuba Consolidated Gold Fields (Siskiyou unit) placed its connected-bucket dredge in operation on Scott River on November 5, 1945. The dredge, which had 72 9-cubic-foot buckets, operated through December 31.

Klamath River district.—The Yreka Gold Dredging Co. operated a connected-bucket dredge with 67 6-cubic-foot buckets in Seiad Valley from October 19 to December 31, 1945. The Gray Eagle Copper Co. operated the Dakin or Gray Eagle mine during the first half of 1945. The mine was closed down in June, and all machinery and equipment were dismantled. Copper ore was treated in the company 700-ton flotation mill and concentrates were shipped to a smelter.

Liberty district.—S. Czerwinski worked the Joubert hydraulic mine during a 2-month period, April 25 to June 25, 1945. Judge Hydraulic Mine carried on hydraulicking at the Judge mine from January 1 to July 4.

Scott Bar district.—George A. Milne carried on hydraulicking at the Quartz Hill mine in November 1945.

STANISLAUS COUNTY

La Grange district.—The La Grange Gold Dredging Co. operated a connected-bucket dredge (No. 4) equipped with 62 10-cubic-foot buckets on the Tuolumne River from September 27 to December 31. The Tuolumne Gold Dredging Corp. operated its connected-bucket dredge throughout 1945 on a one-shift basis. The electrically operated dredge was equipped with 100 12-cubic-foot buckets.

TRINITY COUNTY

Big Bar district.—Perry T. Bennett, lessee, worked 9,367 cubic yards of gravel at the T. & T. hydraulic mine from January 1 to June 1, and recovered 125 ounces of gold and 14 ounces of silver.

Junction City district.—Chapman & Sons hydraulicked the Chapman and Fisher mine during the first 6 months of 1945; 44 ounces of gold and 4 ounces of silver were recovered from 20,000 cubic yards of gravel. The Goldfield Consolidated Mines Co. worked the Red Hill mine by hydraulicking during 1945. The Junction City Mining Co. operated a Yuba electric connected-bucket dredge with 75 10-cubic-foot buckets along Trinity River near Junction City from early in October through December 1945.

Trinity Center district.—The Thompson Divide Mining Co. operated a dragline dredge at the Squirrel Gulch mine from November 25 to December 23.

Weaverville district.—W. E. Woodbury conducted a hydraulic operation at the Rex mine from January 10 to June 23. Thomas Davidson and M. L. Benoist hydraulicked 18,000 cubic yards of gravel at the Canyon (Harman Hill) mine during the first quarter of 1945 and recovered 23 ounces of gold and 2 ounces of silver.

TUOLUMNE COUNTY

East Belt district.—Harper Bros. operated the Eureka mine near Big Oak Flat intermittently from April 1 to November 18, 1945; 109 ounces of gold and 24 ounces of silver were recovered by amalgamation from 5 tons of ore.

Mother Lode district.—Miller & Clemson (Eagle Shawmut Mine) worked the Eagle Shawmut mine from January 1 to November 15, 1945; 61,781 tons of gold ore treated by amalgamation and flotation yielded bullion (containing 98 ounces of gold and 26 ounces of silver) and 1,926 tons of concentrate (containing 4,471 ounces of gold, 2,754 ounces of silver, and 24,891 pounds of copper).

YUBA COUNTY

Camptonville district.—Hydraulicking of old tailings from the Joubert mine by H. M. Allen from January 4 to March 24 produced 50 ounces of gold and 3 ounces of silver.

Yuba River district.—Yuba Consolidated Gold Fields operated five of its fleet of six dredges during the 12 months of 1945, though not concurrently. After the rescinding of WPB Limitation Order L–208 July 1, dredges in addition to the two permitted to operate under a WPB grant resumed work; by the end of the year five dredges were working. The dredges were of the Yuba type, electrically operated, and had the following number and capacity of buckets: Two with 100 18-cubic-foot buckets; one with 126 18-cubic-foot buckets, one with 87 18-cubic-foot buckets, and one with 135 18-cubic-foot buckets.

SILVER, COPPER, LEAD, AND ZINC IN THE CENTRAL STATES

(MINE REPORT)

By A. J. Martin

SUMMARY OUTLINE

SUMMARY

With no change in ceiling prices of copper, lead, and zinc and extension of the Premium Price Plan, nearly all the mines in the Central States producing these metals operated throughout 1945 upon essentially the same economic basis as in 1944. About the only repercussion that followed the end of hostilities was the shut-down of certain copper mines that were operating under special-price Government contracts for copper and were unable to operate at the lower premium price after the contracts were not renewed at the end of August. The manpower shortage hampered production as a whole more severely than in 1944, although it was ameliorated late in the year by return to the mines of veterans and workers from war-industry factories. The output of recoverable copper decreased 26 percent from 1944. The quantity of lead produced was nearly the same as in 1944 and exceeded that of zinc for the first time since 1932; a decrease in lead production in the Tri-State (Kansas-Missouri-Oklahoma) district was offset by expanded output in other districts, mainly the Southeastern Missouri district, where some of the mines shifted men from development work to mining while the lead supply was critical in the first part of the year. The output of zinc decreased 24 percent in quantity from 1944. The largest decrease occurred in the Tri-State district, where there was an 18-percent drop in tonnage of crude ore mined, caused largely by labor shortage, and a decline in the average grade of the ore and old tailings treated. Zinc production in the Wisconsin-Northern Illinois (Upper Mississippi Valley) district increased for the fifth consecutive year.

The silver produced in the Central States is a minor byproduct derived from some of the base-metal ores. No production of gold has been reported from Central States mines since 1940.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of silver, copper, lead, and zinc in the Central States, 1941–45, in terms of recovered metals

Year	Mines producing	Ore and old tailings (short tons)	Silver		Copper	
			Fine ounces	Value	Pounds	Value
1941	447	28, 959, 189	448, 824	$319, 164	95, 680, 000	$11, 290, 240
1942	502	30, 726, 994	130, 884	93, 073	93, 958, 000	11, 368, 918
1943	407	32, 653, 764	161, 917	115, 141	96, 208, 000	12, 507, 040
1944	386	34, 240, 455	148, 898	105, 883	91, 446, 000	12, 345, 210
1945	334	31, 873, 116	118, 883	84, 539	67, 600, 000	9, 126, 000

Year	Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	
1941	209, 362	$23, 867, 268	276, 006	$41, 400, 900	$76, 877, 572
1942	235, 229	31, 520, 686	258, 181	48, 021, 666	91, 004, 343
1943	217, 060	32, 559, 000	222, 707	48, 104, 712	93, 285, 893
1944	201, 577	32, 252, 320	214, 949	49, 008, 372	93, 711, 785
1945	201, 520	34, 661, 440	164, 225	37, 771, 750	81, 643, 729

Mine production of silver, copper, lead, and zinc in the Central States in 1945, by months, in terms of recovered metals

Month	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	11, 809	3, 257	18, 398	15, 930
February	12, 115	2, 921	16, 436	13, 802
March	11, 366	3, 405	18, 123	14, 855
April	10, 237	3, 095	16, 689	13, 727
May	10, 983	3, 378	18, 491	14, 322
June	9, 328	3, 475	15, 795	13, 455
July	10, 611	3, 103	16, 561	13, 210
August	11, 055	2, 586	16, 225	12, 784
September	8, 185	2, 357	15, 944	12, 782
October	8, 157	2, 170	17, 377	14, 297
November	7, 865	2, 263	15, 980	13, 419
December	7, 172	1, 790	15, 501	11, 642
	118, 883	33, 800	201, 520	164, 225

Silver.—The mine output of recoverable silver in the Central States in 1945 comprised 89,460 ounces derived from refining some of the lead bullion made in smelting Southeastern Missouri lead concentrates, 21,863 ounces from copper bullion and native silver recovered from Michigan copper ore, 5,362 ounces from copper concentrates made in treating Missouri lead-copper-cobalt-nickel-iron ore, and 2,198 ounces from lead concentrates produced in treating Southern Illinois zinc-lead fluorspar and lead fluorspar ores.

Copper.—Michigan (Lake Superior region) produced 90 percent of the Central States total output of copper in 1945; the State output comprised 44,265,000 pounds recovered from crude ore and 16,537,000 pounds from old tailings. In 1944 crude ore yielded 63,967,000 pounds and old tailings 20,875,000 pounds. The rest of the Central States output in both years came from the Southeastern Missouri region; part of the copper was contained in byproducts shipped from smelters treating lead concentrates and part in copper concentrates shipped from the Madison mill at Fredericktown, which treated lead-copper-cobalt-nickel-iron ore.

Lead.—Mines in the Central States produced 201,520 tons of recoverable lead in 1945—more than half the United States total mine output. The principal mines are in the disseminated-lead district of Southeastern Missouri. This district, with an output of 173,005 tons of recoverable lead (a 2-percent increase over 1944), continued to be much the largest lead-producing district in the nation. During the 6 World War II years ended with 1945 the district output averaged 175,528 tons of recoverable lead annually and totaled 1,053,165 tons. The Tri-State district (Kansas, Southwestern Missouri, Oklahoma) produced 23,556 tons of lead in 1945 compared with 28,059 tons in 1944. These two districts contributed 98 percent of the Central States lead output in 1945; the rest came from Wisconsin, Illinois, Kentucky, Central Missouri, and Arkansas.

Zinc.—The 50,724-ton drop in mine production of recoverable zinc in the Central States in 1945 was the heaviest in a single year since 1931 and the output of 164,225 tons the lowest since 1934. Production in the Tri-State district, which contributed 85 percent of the Central States total in 1945, was 50,996 tons less than in 1944. A general review of mining and milling in this district is given in this chapter under Southwestern Missouri. The Wisconsin-Northern Illinois district, the annual output of which increased steadily from 1941 to 1945, yielded 12 percent of the Central States total zinc output in 1945 and 8 percent in 1944. Other producing districts were Kentucky-Southern Illinois, Southeastern and Central Missouri, and Northern Arkansas.

MINE PRODUCTION BY STATES AND REGIONS

Mine production of silver, copper, lead, and zinc in the Central States in 1945, by States, in terms of recovered metals

State	Mines producing	Material sold or treated		Silver	
		Crude ore (short tons)	Old tailings (short tons)	Fine ounces	Value
Arkansas	4	14,891			
Illinois	11	[1] 252,271	24,988	2,198	$1,563
Kansas	82	2,693,110	1,883,269		
Kentucky	16	[1] 6,836			
Michigan	12	2,020,618	3,176,314	21,863	15,547
Missouri	61	8,188,913	468,923	94,822	67,429
Oklahoma	100	3,266,151	8,919,155		
Wisconsin	48	338,033	619,644		
	334	16,780,823	15,092,293	118,883	84,539
Total, 1944	386	18,690,633	15,549,822	148,898	105,883

State	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
Arkansas			1	$172	303	$69,690	$69,862
Illinois			3,005	516,860	8,310	1,911,300	2,429,723
Kansas			7,370	1,267,640	48,394	11,130,620	12,398,260
Kentucky			129	22,188	182	41,860	64,048
Michigan	60,802,000	$8,208,270					8,223,817
Missouri	6,798,000	917,730	176,575	30,370,900	22,175	5,100,250	36,456,309
Oklahoma			12,664	2,178,208	69,300	15,939,000	18,117,208
Wisconsin			1,776	305,472	15,561	3,579,030	3,884,502
	67,600,000	9,126,000	201,520	34,661,440	164,225	37,771,750	81,643,729
Total, 1944	91,446,000	12,345,210	201,577	32,252,320	214,949	49,008,372	93,711,785

[1] Excludes lead-bearing material mined with fluorspar and from which some lead was recovered as a byproduct of the mining and milling of the fluorspar.

Mine production of lead and zinc in the Central States in 1945, by regions

Region	Lead [1]		Zinc [2]		Total value
	Short tons	Value	Short tons	Value	
Concentrates:					
Joplin or Tri-State	31,844	$3,969,305	259,001	$28,386,683	$32,355,988
Southeastern Missouri	245,741	21,863,083	1,261	40,390	21,903,473
Upper Mississippi Valley [3]	3,011	273,580	34,758	2,692,643	2,966,223
Kentucky-Southern Illinois	3,872	286,843	8,343	580,576	867,419
Central Missouri	64	7,160	74	5,316	12,476
Northern Arkansas	1	120	852	62,067	62,187
	284,533	26,400,091	304,289	31,767,675	58,167,766
Total, 1944	285,293	[4] 24,754,709	400,995	[4] 40,087,617	[4] 64,842,326
Recoverable metal:					
Joplin or Tri-State	23,556	4,051,632	139,274	32,033,020	36,084,652
Southeastern Missouri	173,005	29,756,860	[5] 570	131,100	29,887,960
Upper Mississippi Valley [3]	2,261	388,892	19,318	4,443,140	4,832,032
Kentucky-Southern Illinois	2,649	455,628	4,735	1,089,050	1,544,678
Central Missouri	48	8,256	25	5,750	14,006
Northern Arkansas	1	172	303	69,690	69,862
	201,520	34,661,440	164,225	37,771,750	72,433,190
Total, 1944	201,577	32,252,320	214,949	49,008,372	81,260,692

[1] Includes galena and small quantity of lead carbonate concentrates.
[2] Includes sphalerite and small quantity of zinc carbonate and silicate concentrates.
[3] Region includes Iowa, Northern Illinois, and Wisconsin; no production in Iowa from 1918 to 1945, inclusive.
[4] Revised figure.
[5] Includes 240 tons recovered from lead-smelter residues.

Quantity and tenor of copper, lead, and zinc ores, old tailings, etc., produced in some [1] Central States, 1943–45, by States

State	1943		1944		1945	
	Ore, etc.	Metal content [2]	Ore, etc.	Metal content [2]	Ore, etc.	Metal content [2]
	Short tons	*Percent*	*Short tons*	*Percent*	*Short tons*	*Percent*
Kansas	4,475,767	1.62	5,229,795	1.54	4,576,379	1.34
Michigan	4,403,594	1.06	5,410,238	.79	5,196,932	.58
Missouri	9,440,151	2.36	9,181,092	2.43	8,657,836	2.33
Oklahoma	13,660,191	1.08	13,611,730	.85	12,185,306	.74
Wisconsin	548,022	3.09	623,811	3.00	957,677	1.81
	32,527,725		34,056,666		31,574,130	

[1] Only small-scale intermittent mining done in Arkansas from 1918 to 1945; Kentucky and Illinois excluded because part of the metal output (lead and zinc) was a byproduct of fluorspar mining, and the quantity of metal-bearing material hoisted could not be determined.

[2] The percentages represent metal content of the ore insofar as it is recovered in the concentrates. In Michigan the metal so recovered is copper; in Missouri, copper, lead, and zinc; and in Kansas, Oklahoma, and Wisconsin, lead and zinc. The relative proportions of the metals are shown in the third table of this chapter and in tables of tenor of ore given in sections devoted to the respective States.

MINING AND METALLURGIC INDUSTRY

The outstanding accomplishment in mining in the Central States in 1945 was the increased production by lead mines in Southeastern Missouri in spite of manpower shortage and the heavy drain upon ore reserves in recent war years. The average grade of the lead ore mined varied little from 1944. The grade of the copper, zinc, and zinc-lead ores declined materially, indicating further depletion of reserves of high- and medium-grade ores and a growing dependency upon the low-grade ore to maintain production rates. Recent technical advances in mechanizing underground operations and economies effected in transportation and milling are important factors in extending the life of the low-grade mines. Most of the decrease in number of producing mines in 1945 resulted from abandonment of small-scale operations where conditions were unfavorable for using mechanized equipment. Drilling and development work on extensions of ore bodies and adjacent territory in the producing areas resulted in maintaining or expanding ore reserves in some places. No important discoveries were reported from exploratory drilling and geophysical investigations conducted outside known mineralized areas. The Bureau of Mines, in cooperation with the Geological Survey, continued to investigate sources of strategic and critical minerals. The work done on copper, lead, and zinc included exploratory drilling, geophysical surveys, field examinations, and metallurgical tests. Some of the work was curtailed with the passing of the war emergency.

Nearly all the mills in the Central States used gravity concentration and flotation. Flotation concentrates comprised 35 percent of the total copper concentrates (excluding copper-lead flotation concentrates from Missouri), 44 percent of the lead concentrates, and 60 percent of the zinc concentrates produced. The location of the smelters that treat the concentrates is given in the 1943 report of this series (Minerals Yearbook, 1943, p. 296). Six waelz plants operated in conjunction with zinc smelters in the Central States treated a total of 239,695 tons of old residues, current residues, mineralized rock, and clean-up material yielding 40,582 tons of oxide averaging 66 percent zinc and about 3 percent lead. Most of the oxide was smelted along with concentrates to produce metal.

REVIEW BY STATES

ARKANSAS

Production of zinc concentrates in Arkansas totaled 852 tons (mostly carbonate) in 1945 compared with 57 tons (all carbonate) in 1944. One ton of lead concentrates was produced in 1945 and none in 1944. Most of the zinc output came from the Big Hurricane open-pit carbonate mine in Searcy County, operated by the Grimmett Construction Co. The mine is equipped with a 500-ton jig- and table-concentration mill. The concentrates were shipped to the Mineral Point smelter at Depue, Ill. The North Star mine near Harrison and the Gloria-Jack Pot at Zinc each shipped a few lots of sulfide ore to custom mills in the Tri-State district. The Brewer near Ponca shipped a car of zinc carbonate to the Athletic smelter at Forth Smith and a ton of lead concentrates to the Eagle-Picher smetler at Galena, Kans.

ILLINOIS

Northern Illinois (see section on Wisconsin for output data).—The principal producers of zinc and lead in Northern Illinois in 1945 were the Graham-Ginte mine of the Ginte Mining Co. and the Gray mine of Tri-State Zinc, Inc. The Graham-Ginte is equipped with a 400-ton mill producing bulk zinc-iron-lead rougher jig concentrates, sold to the Vinegar Hill Zinc Co. custom flotation mill at Cuba City, Wis., and finished lead concentrates, sold to local buyers. The Gray mine is a newly developed property that began producing late in 1944. It is opened by a 6- by 12-foot shaft 200 feet deep and drifts on the 197-foot level. The ore is treated in the 600-ton jig and flotation mill at the shaft. The zinc concentrates averaged 62.0 percent zinc and the lead concentrates 75.5 percent lead. After August the mill also treated old tailings from other properties nearby. The Big Six (North Unity) mine shipped crude ore to the Vinegar Hill mill. The Bureau of Mines did exploratory drilling on the Bautsch, Boevers, Gray, and Bell (Southcott) properties.

Southern Illinois.—Zinc and lead sulfides are mined along with fluorspar in some of the mines of Southern Illinois. The Mahoning Mining Co. group of mines near Cave in Rock has been the principal producer of zinc since 1939 and of lead since 1940. The ore occurs generally in flat-lying or blanket formation with alternating layers, one consisting largely of fluorspar and the other mostly of sphalerite and galena. The shafts operated in 1945 were the W. L. Davis-Deardorff, East Green, and West Green, which are 311, 230, and 363 feet deep, respectively. The ore from all three shafts was trucked to the company flotation mill at Rosiclare for treatment. The products of the mill were fluorspar concentrates (mostly acid grade), zinc concentrates containing 63.0 percent zinc, and lead concentrates containing 70.3 percent lead. Besides company ore, the mill treated custom ore and bulk concentrates and middlings containing zinc, lead, and fluorspar from other mines and mills in Southern Illinois and Kentucky; the Illinois custom shippers to the mill were the Rosiclare Lead & Fluorspar Mining Co. and the Aluminum Ore Co. The Minerva Oil Co. fluorspar-zinc mine, which began producing in March 1944, operated steadily in 1945. The mine is opened by a 645-foot double-compartment shaft and is equipped with a 200-ton flotation mill.

The fluorspar concentrates shipped were of ceramic grade and the zinc concentrates averaged 63.3 percent zinc. Operations of the company are described in an article in Pit and Quarry of June 1945. The total output of lead concentrates in Southern Illinois in 1945 was 3,657 tons averaging 70.3 percent lead and about 5 ounces of silver to the ton, and that of zinc concentrates was 8,019 tons averaging 63.1 percent zinc. Production (in terms of recoverable metals) was 2,520 tons of lead, 2,198 ounces of silver, and 4,553 tons of zinc, compared with 1,878 tons of lead, 2,437 ounces of silver, and 5,569 tons of zinc in 1944.

KANSAS

The Kansas zinc and lead mines are in the Tri-State (Joplin) mining region, embracing parts of Cherokee County, Kans., and Ottawa County, Okla., and about 12 counties in Southwestern Missouri. General details of the Tri-State mining industry are given in the following pages on Southwestern Missouri.

Production of zinc concentrates in Kansas decreased 24 percent in 1945 from 1944 and lead concentrates 18 percent. The Baxter Springs-Blue Mound-Treece area produced 77,646 tons of zinc concentrates and 8,621 tons of lead concentrates (87 and 86 percent, respectively, of the State total) in 1945. About 33 percent of the crude ore mined in the area was concentrated in the Central mill of the Eagle-Picher Mining & Smelting Co. at Cardin, Okla. Most of the ore was transported to the mill over the Northeast Oklahoma Railroad, which has spur tracks from the main line to the principal ore-hoisting shafts. Eagle-Picher mines in this area shipping to the mill were the Big John, Cherokee, Leopard-Youse Slaughter, Parmenter, Sim C., Webber mines, Westside mines, and Wilbur. Churn drilling north of the Westside-Foley shaft disclosed ore bodies at a deeper level than those to the south, and the company nearly completed sinking a new 455-foot shaft on the north end of the Foley lease. The company drilling campaign was extended northward over a considerable area and continued throughout the year. The Paxson, Stoskopf, and Swalley "D" mines and the Paxson mill were operated by Eagle-Picher as agent for the Metals Reserve Company. The Mid-Continent (Wright and Longacre) mines, Ebenstein (Bilwil), and Mark Twain shipped ore to the Central mill.

Mine production of lead and zinc in Kansas, 1941–45

Year	Mines producing	Lead concentrates		Zinc concentrates		Metal content [1]			
						Lead		Zinc	
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	58	18,888	$1,264,147	131,406	$6,595,506	14,538	$1,657,332	71,403	$10,710,450
1942	81	12,253	1,167,302	103,247	6,926,745	9,419	1,262,146	55,874	10,392,564
1943	82	12,243	[2] 1,473,891	105,656	[2] 10,792,583	9,213	1,381,950	56,944	12,299,904
1944	85	12,176	[2] 1,418,781	117,827	[2] 11,959,317	9,394	1,503,040	63,703	14,524,284
1945	82	9,967	1,236,322	89,305	9,715,271	7,370	1,267,640	48,394	11,130,620

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the value of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

[2] Revised figures, resulting from inclusion of overceiling payments not previously reported for certain concentrates.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Kansas, 1944–45

	1944		1945	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore and old tailings milled……short tons	3,175,152	2,054,643	2,693,110	1,883,269
Total concentrates produced:				
Galena……do	12,170	6	9,967	----------
Sphalerite……do	109,590	8,237	88,830	5,475
Ratio of concentrates to ore, etc.:				
Lead……percent	0.38	----------	0.37	----------
Zinc……do	3.45	0.40	3.11	0.29
Metal content of ore, etc.:[1]				
Lead……do	.30	----------	.28	----------
Zinc……do	2.08	.23	1.88	.17
Average lead content of galena concentrates……do	78.73	71.85	75.42	----------
Average zinc content of sphalerite concentrates……do	60.23	58.03	60.32	58.54
Average value per ton:				
Galena concentrates	[2] $116.53	$104.33	$124.04	----------
Sphalerite concentrates	[2] 101.57	100.52	107.83	$123.52

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.
[2] Revised figure.

The Ballard central mill of the St. Louis Smelting & Refining Co. treated company ore from the Ballard, Clark, English "O", Keith (North 60), Moore, Shanks, Slaughter, and Walter H. mines and custom ore from the Keith (South 20) mine and the C. & M. Mining Co. lease on the St. Louis No. 4 mine in Oklahoma. The Smith and Swalley (Beck) mines and the MacArthur mine continued to ship ore to the Beck No. 3 mill at Baxter Springs. The Liza Jane (Lula Bell) mine shipped to the Farmington mill in Oklahoma until that mill burned on October 14, when the ore was diverted to custom mills. The Harris Mining Co. operated the Robinson and Silver Fox mines (closed during the year) and the E–W No. 24, shipping the ore to the Youngman mill. This mill also treated custom ore from the Federal Muncie group (closed in March), the Southern mine (closed in April), and the Baird in Oklahoma. The Bilharz Mining Co. operated the Bilharz-Brewster mine and mill until October 31, when both were closed owing to expiration of the lease. In November the mill was purchased by the M. &.W. Mining Co., which operated it on ore from company mines in Oklahoma. The Dines mill treated company ore from the Dines No. 3 (Okla.), Tar Creek, and Hartley mines and custom ore from the C. K. & E. (Stebbins) and Douthit (Robinson). The Wade-Rea mill handled company ore from the Wade-Hunter mine and some custom ore. The New Blue Mound (Worley) mill treated old tailings and custom mine dirt from January to March; it was then closed and dismantled. The Barr Cleanup Co. ran a section of the old Webber mill on clean-up material, mostly from Oklahoma. The Captain tailing mill was run continuously. The Semple (Early Bird) tailing mill, a large producer since 1935, was closed May 19, 1945. F. W. Evans Mines installed heavy equipment and carried on stripping operations to open the caved part of the old Peru mine workings and also built a plant for crushing, sizing, and washing barren rock for sale as railroad ballast.

In the Galena area the principal producers were the Eagle-Picher Murphy and Illinois mines, the Galena Mining Co. Southside mine, and the Mess Cave, Murray-Davis, North End, and Rosenberry small-scale open-pit operations; most of the ore was shipped to the Central mill. The Eagle-Picher lead smelter and lead and zinc pigment plant at Galena purchases most of the lead concentrates produced in the Tri-State district. At Peacock the Carson Mining & Milling Co. continued to operate its tailing mill.

In the Waco district (Kansas part) the St. Louis Smelting & Refining Co. operated its No. 9 mill and the Barnsdall and Grasselli mines. Besides company ore the mill handled custom ore from the Stotts City Mining Co. Bennett leases. The F. W. Evans Mines operated its mill and the St. Louis and O'Neill groups. Both mills also handled ore from other mines across the State line in Missouri.

KENTUCKY

Mines in Kentucky yielded 182 tons of recoverable zinc and 129 tons of lead in 1945 compared with 341 and 170 tons, respectively, in 1944. The Twin Valley (old Gratz) zinc-lead mine and 100-ton mill in Owen County operated in January and February 1945; they were then idle until September, when they were taken over by the K. T. Dome Mining Syndicate, which worked mostly on mine development and mill repairs the rest of the year. In Crittenden County the Delhi Fluorspar Co. shipped byproduct lead concentrates and the United States Coal & Coke Co. produced zinc and lead concentrates by flotation of tailings in its fluorspar mill at Mexico. In Livingston County the Kentucky Fluor Spar Co. shipped byproduct lead concentrates. Other fluorspar producers shipped material containing zinc, lead, and fluorspar to the Mahoning mill at Rosiclare, Ill.; the principal shipper was the Eagle Fluor Spar Co. at Salem. The Corod Minerals Corporation fluorspar-zinc-lead flotation mill at Marion was idle throughout 1945.

MICHIGAN

The mine production of recoverable copper in Michigan decreased 28 percent in 1945 from 1944. Operations from January to August were hampered by acute manpower shortage. Certain mines that were operating under special-price Government contracts for copper were closed when the contracts were not renewed at the end of August; the price obtainable under the Premium Price Plan was inadequate to enable these mines to continue operations. The district has been producing continuously since 1845, and the best ore in many of the mines has been extracted or the workings have reached deep levels where the cost of mining is high. The average price per pound of fine copper paid for the mine output (including increment from special prices and premiums for overquota production) was 12.83 cents in 1942, 16.19 cents in 1943, 16.54 cents in 1944, and 17.77 cents in 1945. The ceiling price was 12 cents throughout the 4-year period. In 1945 mine mills treated 2,020,618 tons of rock yielding 44,265,000 pounds of fine copper compared with 2,382,525 tons yielding 63,967,000 pounds in 1944. Reclamation plants handled 3,176,314 tons of old tailings yielding 16,537,000 pounds of copper compared with 3,027,713 tons in 1944 yielding 20,875,000 pounds.

The concentrate ("mineral") produced at mills in Michigan in 1945 and the mass copper shipped direct from the mines were smelted at plants of the Calumet and Hecla Consolidated Copper Co. at Hubbell and the Copper Range Co. at Houghton. The Copper Range smelter was shut down early in October and remained idle the rest of the year. Some of the copper bullion was cast into anodes and shipped to the electrolytic refinery at Laurel Hill, N. Y., where silver was recovered. Most of the bullion, however, is not desilverized, because of the cost and because silver is a desirable element in copper used in the manufacture of many articles. The report of this series for 1944 gives additional data on silver in lake copper and native silver recovered in the mills.

Mine production of silver and copper in Michigan, 1941–45 [1]

Year	Silver (fine ounces)	Copper			Concentrate ("mineral")		Crude ore and sands (short tons)
		Pounds	Yield		Pounds	Yield (percent copper)	
			Pounds per ton of crude ore and sands	Percent			
1941	60,796	92,880,000	21.7	1.08	141,100,268	65.8	4,282,448
1942	61,674	91,358,000	20.9	1.05	141,372,582	64.6	4,362,640
1943	48,479	93,528,000	21.2	1.06	143,142,155	65.3	4,403,594
1944	54,218	84,842,000	15.7	.78	129,646,181	65.4	5,410,238
1945	21,863	60,802,000	11.7	.58	97,467,825	62.4	5,196,932

[1] Figures based upon actual recovery of copper from "mineral" smelted and estimated recovery from "mineral" not smelted during year.

Value of silver and copper produced in Michigan mines, 1941–45

Year	Silver	Copper		Total	Year	Silver	Copper		Total
		Total	Per ton of crude ore and sands				Total	Per ton of crude ore and sands	
1941	$43,233	$10,959,840	$2.56	$11,003,073	1944	$38,555	[1] $11,453,670	[1] $2.12	$11,492,225
1942	43,857	[1] 11,054,318	[1] 2.53	11,098,175	1945	15,547	[1] 8,208,270	[1] 1.58	8,223,817
1943	34,474	[1] 12,158,640	[1] 2.76	12,193,114					

[1] Value of copper calculated at average weighted price (including Government bonuses) for all domestic copper sold (see first table of this chapter, footnote 3). If calculated at actual prices paid to Michigan operators, the value of the copper was—1942: $11,722,792, or $2.69 to the ton of crude ore and sands; 1943: $15,139,831, or $3.44 to the ton; 1944: $14,033,131, or $2.59 to the ton; 1945: $10,801,506, or $2.08 to the ton.

The mines and reclamation plants of the Calumet and Hecla Consolidated Copper Co. continued in 1945 to contribute the largest part of the Michigan output of copper. The operating mines comprised the Ahmeek, Central (closed December 31), Douglass, Iroquois, North Kearsarge, Peninsula, Allouez, and Centennial. Shortage of labor hampered production. The ore from all eight mines was treated in the 6,400-ton Ahmeek stamp mill by gravity concentration followed by flotation of the fines. According to the annual company report to stockholders, from which the following data are extracted, the mill in 1945 stamped 1,395,064 tons of rock yielding 28,796,120 pounds of copper. The output of primary copper from the two reclamation plants totaled 10,261,172 pounds. The Lake Linden plant operated on conglomerate tailings 3 months and on amygdaloid tailings the rest of the year. The small quantity of conglomerate material now remaining is contiguous to, or underlies, operating plants

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and can be treated only as a final clean-up preparatory to shutting down some of the Lake Linden treatment plants permanently. The amygdaloid tailings are of such grade that they are of commercial value at present only when copper sells at 17 cents a pound or higher. The Tamarack reclamation plant, operating on amygdaloid tailings under the Premium Price Plan, showed a small profit. The smelter treated company and custom concentrates, refined copper on toll for the Metals Reserve Company and private companies, and treated a substantial tonnage of secondary copper. A new secondary copper department was organized, equipment was installed, and treatment of many grades of secondary material on a large scale was begun. Purchase of the properties of the Peninsula Copper Co., held under lease and option since June 13, 1938, was completed during the year. Underground development at all operating shafts proceeded at a normal rate and developed ground of average grade. Exploration of company holdings by diamond drilling continued throughout the year. The results of drilling in the recently acquired Clark and Keweenaw Copper lands in the Copper Harbor area were much less encouraging than indicated by reports of drilling done in previous years, but drilling was being continued. The many deposits thus far explored are of too low a grade for present exploitation.

The Copper Range Co. operated its Champion and Globe mines until September 20, when operations were suspended owing to discontinuance of the Government special prices for copper and inability to complete arrangements to operate under the Premium Price Plan. The stamp mill and smelter were shut down soon after production stopped at the mines. All essential maintenance work was continued at the mines, mill, and smelter in order that operations can be resumed when conditions are favorable. The tailing plant at the Freda mill was operated from April to August. The smelter treated company concentrates and also handled custom concentrates and mass copper from the Isle Royale and Quincy mines. Other data abstracted from the annual company report to stockholders follow: The drilling program at the White Pine property was completed in 1945. An exploration shaft, known as the Bill Schacht Shaft, was started in June and progress by the end of the year was satisfactory. The mill tailings at the Baltic mill at Redridge were examined and studied. About 8,000,000 tons of recoverable tailings having an average copper content of about 7½ pounds per ton were indicated. Further work is under way to determine if the copper in these tailings can be recovered profitably.

The Isle Royale Copper Co. operated throughout 1945, but shortage of labor limited operations from January through August; later, experienced labor became available. According to the annual company report to stockholders, production of refined copper was 5,599,280 pounds, a reduction of 2 percent from 1944. Copper recovered per ton of rock stamped was 18.946 pounds compared with 18.344 pounds in 1944. Production costs, including selling and delivery, were 18.929 cents a pound. Depreciation and depletion totaled 1.448 cents, making an over-all cost of 20.377 cents a pound. From January to August the company operated under a special contract with the Metals Reserve Company and from September to December under the Premium Price Plan. The lower price received for copper under the Premium Price Plan necessitated a revision of the operational program. All development work was suspended and the entire underground force was placed on production, which resulted in a 30-percent increase in production rates for the rest of the year. Experimental work done to determine the feasibility of reworking the stamp sands shows that their copper content is low, and until new methods are devised to reduce greatly present grinding costs, these sands must be considered of little economic value.

The output of copper from the Quincy Mining Co. tailings reclamation plant increased substantially over 1944. Additional equipment was installed in the plant to increase its capacity and obtain greater efficiency in handling the very fine sands. The original capacity of the mill was 4,000 tons daily. The Quincy mine was shut down August 31, 1945, when the Metals Reserve Company ceased paying special prices for the copper produced.

MISSOURI

The mine output of lead in Missouri (the chief lead-producing State for the past 38 years) increased 1 percent in 1945 over 1944 and that of zinc decreased 39 percent. The lead output comes largely from St. Francois and Madison Counties in the Southeastern Missouri region. Silver and copper are recovered as byproducts in smelting lead concentrates produced in this region, and considerable copper and a little silver have been recovered in some years (including 1944 and 1945) from lead-copper-cobalt-nickel-iron ore mined in the southern part of the region. Silver recovered in 1945 totaled 94,822 ounces and copper 3,399 tons compared with 92,243 ounces and 3,302 tons, respectively, in 1944. In the sale of the lead concentrates, no value is attached to the silver and copper, as the quantity recovered per ton of concentrates is very small. The output of zinc comes mostly from zinc-lead ore mined in Southwestern Missouri. The Central district of Missouri, an intermittent producer of zinc and lead, had a small output in each of the years 1941–45, inclusive; the figures are included with those of Southeastern Missouri in the table that follows.

Mine production of lead and zinc in Southeastern and Central Missouri, 1941–45

Year	Lead concentrates (galena)		Zinc concentrates [1]		Metal content [2]			
					Lead		Zinc	
	Short tons	Value [3]	Short tons	Value	Short tons	Value	Short tons	Value
1941	228,572	$15,404,226	5,192	$73,202	164,388	$18,740,232	1,100	$165,000
1942	277,255	19,426,540	1,739	41,913	197,432	26,455,888	[4] 842	156,612
1943	257,305	18,490,413	2,284	99,710	179,134	26,870,100	[5] 923	199,368
1944	243,279	19,920,200	3,206	112,485	169,962	27,193,920	[6] 1,508	343,824
1945	245,805	21,870,243	1,335	45,706	173,053	29,765,116	[7] 595	136,850

[1] Includes zinc-lead carbonate concentrates.
[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[3] Values given are to a certain extent arbitrary, as part of the lead concentrates are smelted by the producer.
[4] Includes 450 tons recovered from lead-smelter slags.
[5] Includes 360 tons recovered from lead-smelter slags.
[6] Includes 776 tons recovered from lead-smelter slags and byproduct matte from lead smelting.
[7] Includes 240 tons recovered from byproduct matte from lead smelting.

Mine production of lead and zinc in Southwestern Missouri, 1941–45

Year	Lead concentrates				Zinc concentrates				Metal content [1]			
	Galena		Carbonate		Sphalerite		Silicate		Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	2,084	$125,730	90	$4,379	38,513	$1,923,472	1,277	$14,355	1,521	$173,394	20,832	$3,124,800
1942	2,790	303,331	20	864	66,881	4,791,020	1,510	23,940	2,116	283,544	35,552	6,612,672
1943	7,679	908,591			56,357	5,724,079	1,037	51,261	5,776	866,400	29,490	6,369,840
1944	6,294	752,796	9	855	64,651	6,898,980	2,453	218,017	4,721	755,360	35,118	8,006,904
1945	4,679	635,031			40,156	4,605,647	606	44,600	3,522	605,784	21,580	4,963,400

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.

Tenor of lead ore and concentrates in Southeastern Missouri disseminated-lead district, 1941–45

	1941	1942	1943	1944	1945
Total lead ore [1] short tons	5,737,230	7,107,191	6,831,377	6,535,874	6,675,767
Galena concentrates in ore percent	3.98	3.90	3.76	3.72	3.68
Zinc content of ore do	(2)	(2)	(2)	(2)	(2)
Average lead content of galena concentrates percent	73.31	72.65	70.99	71.02	71.66
Average value per ton of galena concentrates	$67.39	$70.04	$71.79	$81.78	$88.95

[1] Includes lead-copper ore.
[2] Figures not available.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Southwestern Missouri, 1944–45

	1944		1945	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled short tons	2,052,979	516,894	1,482,084	468,923
Total concentrates produced:				
Lead do	6,299	4	4,674	5
Zinc do	63,033	4,071	37,404	3,358
Ratio of concentrates to ore, etc.:				
Lead percent	0.31	0.001	.32	.001
Zinc do	3.07	.79	2.52	.72
Metal content of ores, etc.: [1]				
Lead do	.23		.24	.001
Zinc do	1.79	.44	1.49	.40
Average lead content of galena concentrates do	76.44	62.00	76.81	65.00
Average lead content of lead carbonate do	64.00			
Average zinc content of sphalerite concentrates do	58.97	56.50	59.43	56.25
Average zinc content of silicates and carbonates do	42.11		37.79	
Average value per ton:				
Galena concentrates	$119.61	$109.00	$135.77	$92.60
Lead carbonate concentrates	95.00			
Sphalerite concentrates	108.37	81.99	116.95	89.95
Zinc silicates and carbonates	88.88		73.60	

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

Southeastern and Central Missouri.—Production of recoverable lead in Southeastern Missouri was 173,005 tons in 1945 compared with 169,622 tons in 1944. The output in 1944 represented 41 percent of the United States total mine production and in 1945 close to 45 percent.

The bulk of the district output comes from the mines of the St. Joseph Lead Co. in St. Francois County. The groups operated in 1945—the same as in other recent years—were the Bonne Terre, Desloge, Leadwood, and Federal. Each group has a central ore-hoisting shaft and a mill. Other shafts are used for men, supplies, and poor rock. The depth of the 13 operating shafts ranged from 181 to 755 feet and averaged 424 feet. The four mills together have a total daily capacity of 21,400 tons of ore. Treatment is by table concentration followed by flotation. Owing to the need for increasing lead production in the first part of the year, the company transferred some men from development work to mining and operated the mines beyond their economic capacity. According to the company annual report to stockholders, the demand for lead necessitated continuance of uneconomic production rates after the end of 1945. Owing to lack of development work the "proved" ore reserves were less at the end than at the beginning of the year, but with the return of former employees from military service additional exploration work could be undertaken. Regarding the electrothermic zinc plant at the Herculaneum smelter, the annual report stated that the employment of additional men would permit completion of alterations to the slag furnace, which was last operated in 1944, when the process was proved to be an efficient one and the quality of the zinc and lead metals recovered from the smelter slag was found to be satisfactory. The smelter treats part of the concentrates produced in the company mills and also handles custom concentrates from other mills, mostly in the Southeastern Missouri region. The rest of the company concentrates are shipped to the Federal smelter at Alton, Ill. The concentrates contain a little silver, copper, and zinc, some of which were recovered in byproducts at smelters and refineries.

In Madison County the Mine La Motte mine, equipped with a 1,500-ton mill, continued to be the largest producer of lead. The property is owned by the Mine La Motte Corp. and operated by the St. Joseph Lead Co. Two shafts 115 and 307 feet deep were operated. The St. Louis Smelting & Refining Co. operated its Madison mine and 600-ton all-flotation mill steadily. The ore contains lead, copper, cobalt, nickel, and iron; the products of the mill were copper-lead, lead-copper, cobalt nickel, and iron concentrates. The lead-copper concentrates were shipped to the Herculaneum smelter, the copper-lead concentrates to the Garfield (Utah) and El Paso (Tex.) smelters, and the other concentrates were mostly stored at the mine. After midyear, operations centered on producing lead, and the output of the other metals decreased. The Park City Consolidated Mines Co. ran its Ruth mine and 500-ton flotation mill throughout the year. The Fredericktown Lead Co., operating its 400-ton mill and the Catherine and Fleming mines, increased production. Other companies were active in leasing and prospecting (mostly by geophysical methods) in Madison and Sainte Genevieve Counties. The Bureau of Mines made a magnetic survey near Fredericktown.

At Valles Mines, Jefferson County, the DeSota Lead & Zinc Co. 200-ton mill operated most of the year on zinc-lead-iron carbonate ore from dumps on the Valle Mining Co. properties; the concentrates were shipped to the Ozark pigment plant at Coffeyville, Kans.

In Central Missouri the open-pit zinc-lead-coal mine and 100-ton jig mill on the Monarch Coal & Mineral Co. land in Moniteau County, operated by the Wemhaner Mining Corporation since 1940, were closed in May 1945. Small lots of galena were shipped from barite diggings.

Southwestern Missouri.—The following table, the first four paragraphs, and the graphs under this heading pertain to the Tri-State mining industry as a whole; the remaining text reviews mining and milling in Southwestern Missouri only.

Production of lead and zinc concentrates in the Tri-State district (Kansas, Oklahoma, and Southwestern Missouri), 1941–45

Year	Ore, etc., milled (short tons)	Concentrates produced (short tons)		Concentrate recovery (percent)		Average assay of concentrates (percent)		Average value per ton of concentrates	
		Lead	Zinc	Lead	Zinc	Lead	Zinc	Lead	Zinc
FROM CRUDE ORE									
1941	8,091,579	53,329	404,367	0.66	5.00	78.27	60.36	$67.15	$50.33
1942	8,587,337	44,397	378,751	.52	4.41	78.35	59.86	99.55	68.00
1943	9,430,812	45,941	319,379	.49	3.39	76.68	59.46	[1] 121.12	[1] 101.72
1944	9,118,388	36,544	301,854	.40	3.31	77.79	59.72	[1] 120.47	[1] 105.64
1945	7,441,345	31,643	217,790	.43	2.93	75.61	59.96	125.00	110.48
FROM OLD TAILINGS REMILLED									
1941	10,518,611	361	74,036	0.003	0.70	51.52	58.80	$44.38	$48.71
1942	10,239,121	460	65,096	.004	.64	55.87	57.84	80.06	79.10
1943	11,270,106	404	56,857	.004	.50	50.25	57.88	66.42	93.78
1944	12,293,010	390	53,547	.003	.44	51.79	58.26	72.07	98.18
1945	11,271,347	201	41,211	.002	.37	51.24	58.67	69.12	104.97
DISTRICT TOTAL									
1941	18,610,190	53,690	478,403	0.29	2.57	78.09	60.12	$67.00	$50.08
1942	18,826,458	44,857	443,847	.24	2.36	78.12	59.57	99.35	69.63
1943	20,700,918	46,345	376,236	.22	1.82	76.45	59.22	[1] 120.65	[1] 100.52
1944	21,411,398	36,934	355,401	.17	1.66	77.52	59.50	[1] 119.96	[1] 104.51
1945	18,712,692	31,844	259,001	.17	1.38	75.45	59.75	124.65	109.60

[1] Revised figures, resulting from inclusion of overceiling payments not previously reported for certain concentrates.

Although the output of zinc and lead in the Tri-State district decreased heavily in 1945, the district continued to be much the largest zinc-producing district in the United States and ranked third in lead production. As in other recent years, a substantial part of the output came from remnants of ore bodies left in old mines and from other low-grade deposits that had not been commercial at pre-war concentrate prices but could be worked at the higher prices paid under the Premium Price Plan. Such deposits and the low-grade portions of the richer ore bodies now being worked constitute the largest part of the ore reserves of the district. Their utilization has been facilitated by mechanizing underground operations and effecting economies in transportation and milling, but much of the advantage thus gained has been offset by increases in the cost of labor and materials. To maintain the district output at the level of 1945 during the next few years would require continued high prices for concentrates—probably approximating those now obtainable under the Premium Price Plan. If prices should recede to a point at which the low-grade ore could not be utilized along with the high-grade, production will probably decline at a fairly rapid rate unless important new discoveries are made.

The method of marketing the mine output of the Tri-State or Joplin region is explained in the reports of this series for 1940 and 1941. The total value given for all the concentrates is based upon actual receipts by the sellers, including premiums paid by the Government since February 1, 1942, for overquota mine production. The quoted weekly market price for zinc concentrates at Joplin remained at

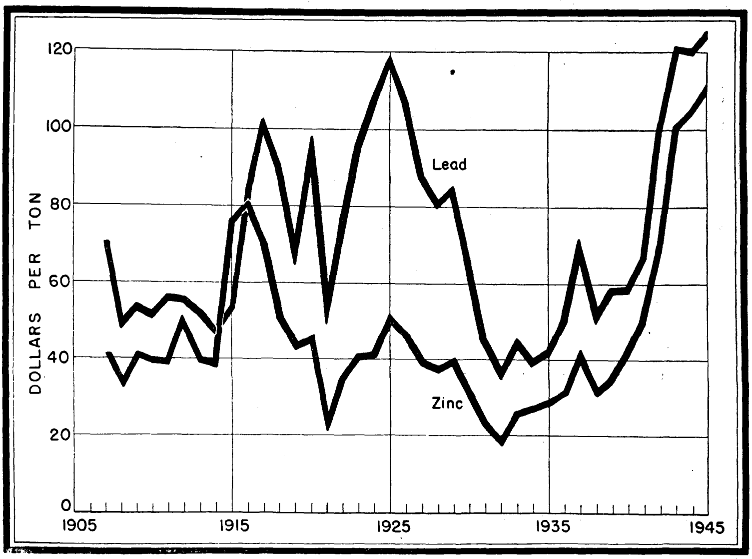

FIGURE 1.—Average prices received by sellers per ton of concentrates in the Tri-State district, 1907–45.

$55.28 a ton throughout 1945 but was reduced to $50 the first week in January 1946. The reduction resulted from an increase in the smelting charge caused by termination of the $5-a-ton Government subsidy paid to smelters on Tri-State concentrates treated. The quoted metal contract price on galena continued at $76.01 throughout 1945. Government premium payments for 60-percent zinc concentrates continued at $29.70 a ton for assigned production under the A-level quota, $59.40 for B-level, and $89.10 for C-level; for 80-percent lead concentrates the payments were $41.80 for A-level and $83.60 for B-level.

Shortage of labor hampered operations severely in 1945. The number of men employed directly by the mining companies dropped from around 6,000 in July 1944 to 5,000 in July 1945 and did not increase materially for several months after the end of hostilities in August. Production of concentrates in the last half of 1945 was 11 percent less than in the first half. About 50 mills were operating in the region in December 1945, of which 16 were tailing mills, compared with 52 in December 1944, including 16 tailing mills. The mine mills, a number of which treated company and custom ore, together

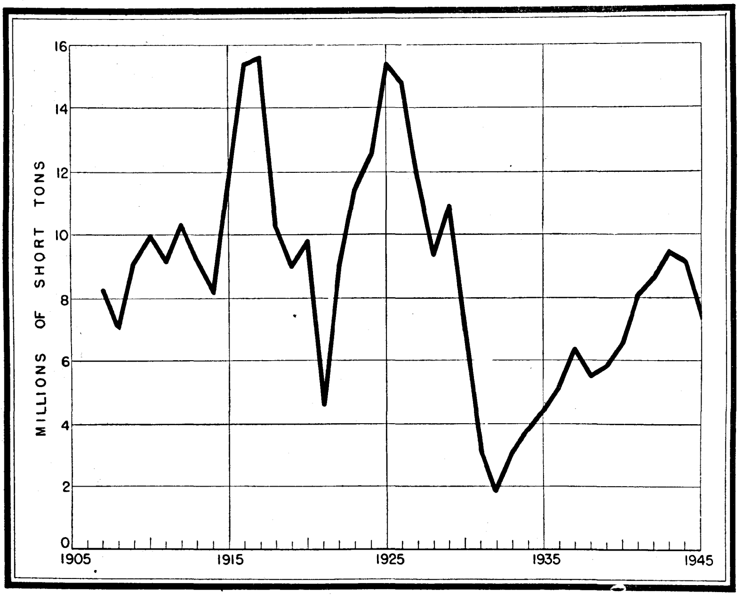

FIGURE 2.—Quantity of crude ore milled in the Tri-State district, 1907–45.

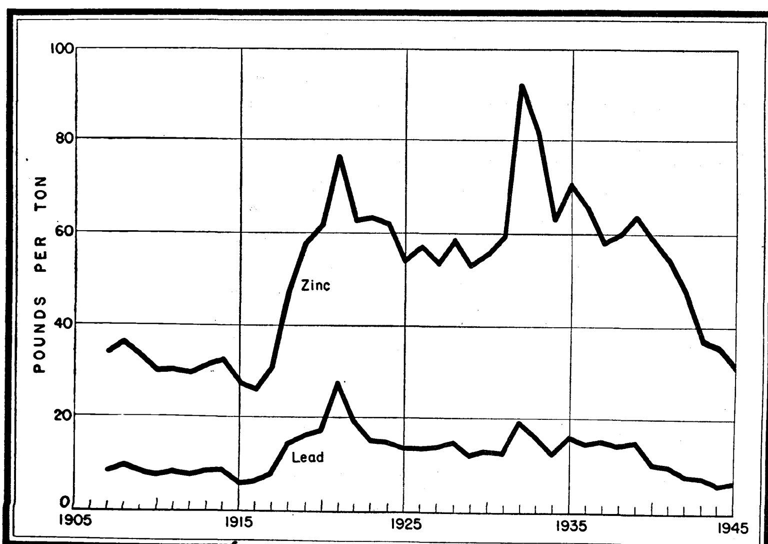

FIGURE 3.—Metal recovered per ton of crude ore (rock) milled in the Tri-State district, 1907–45.

served about 190 mines operated by 80 companies. These mines do not include small gouges and clean-ups but include one important mill clean-up operation and 14 of the larger clean-ups of boulder piles at idle shafts; the total producing mines, gouges, and clean-ups was 226. Eleven companies operated 15 tailing mills throughout the year; in addition there were 7 small-scale or intermittent tailing operations. Stocks of concentrates in the mill bins were small at the end of the year. Churn drilling by the mining companies was confined chiefly to extensions of ore bodies and prospecting in or near known mineralized areas. The Bureau of Mines did exploratory drilling in the Baxter Springs, Galena, Joplin, Melrose (geophysical survey also), and Racine areas. Facilities for aluminum-powder treatments to prevent silicosis were being installed by the mine operators as the year ended.

In Southwestern Missouri production of zinc concentrates decreased 39 percent from 1944 and lead concentrates 26 percent. The Oronogo Circle open-pit mine was again the largest single producer of zinc in Missouri. Part of the ore was treated in the Eagle-Picher leased American mill on the property (closed November 1), and part was shipped to the Central mill in Oklahoma. Fenix & Sons, operating a shaft on the Oronogo Mutual lease, shipped ore to the Central mill. The newly reopened Eagle-Picher Needmore mine was about ready to ship ore in December. The La Tosca (Fenix & Martin) mine and mill continued producing except during March, April, and May. Kansas Explorations, Inc., operated the Snapp mill and the Buckingham mine all the year and the Snapp mine from January to May; the company also continued to operate its Jasper mine and mill near Joplin. Other producers near Joplin and Thoms Station included the Missouri Mining Co. tailing mill, the O'Jack and Swartz mines (ore treated in the C. & O. or Southside mill), and the Big Tom, Little Judy, and Little Pat (ore shipped to the St. Louis Mining & Milling Co. custom mill at Thoms Station). The C. G. & C. Co. sank a shaft on the Potter land and leased the Northside mill, which had been idle since the Northside mine was closed in February; the mill was used to treat custom ore in November and December.

The Federal Mining & Smelting Co. operated the company-owned Granby-American and Duenweg mines and mills throughout the year; the leased Granby-Davis mine was closed June 1 but was purchased by Federal in November. The American Zinc, Lead & Smelting Co. continued to operate its Hunter mines and mill at Aurora. Producers in the Missouri part of the Waco district included the Gascho and High Five (St. Louis) and O'Neill (F. W. Evans) mines (ore treated in company mills in Kansas) and the C. C. Playter (Reynolds) mines and mill. The F. W. Evans Mines also worked the McBee and Martin mines at Smithfield until August and reopened the Sucker Flat open-pit mine and washing-concentrating plant at Webb City, formerly operated by Cooley Bros. The Capital mine and mill at Stotts City were operated until March, when heavy rains flooded the mine; the mill treated some old tailings after October. The Wentworth Mining & Milling Co. resumed operations in June. Other small producers of sulfide concentrates were the Blue Bonnet Mining Co., which treated old tailings in the Navy Bean mill near Wentworth; the New Dalite mine near Carthage (ore milled in the Berkey mill at Alba); the Dividend at Spurgeon; the Hughes sand-slime plant and Gaunt (old Sciota) tailing mill at Webb City; and the Mary Arnold mine near Ozark. The Southwest silicate-carbonate mine and 250-ton mill at Stark City operated most of the year, and the Alice mine in Ozark County shipped sorted crude carbonate and sulfide ores.

OKLAHOMA

Mining and milling in the Tri-State region—which includes Northeastern Oklahoma—are discussed in the preceding pages on Southwestern Missouri. Mines and tailing mills in Oklahoma produced 50 percent of the total Tri-State output of zinc and 54 percent of the lead in 1945 compared with 48 and 50 percent, respectively, in 1944. The zinc output decreased 24 percent from 1944 and lead 9 percent.

Mine production of lead and zinc in Oklahoma, 1941–45

Year	Lead concentrates (galena)		Zinc concentrates (sphalerite)		Metal content [1]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	32,628	$2,202,876	307,207	$15,427,235	25,021	$2,852,394	166,602	$24,990,300
1942	29,794	2,985,285	272,209	19,163,622	22,806	3,056,004	146,510	27,250,860
1943	26,423	3,208,885	[2] 213,195	21,251,796	19,733	2,959,950	114,085	24,642,360
1944	18,455	2,258,188	170,470	18,067,967	13,944	2,231,040	91,449	20,850,372
1945	17,198	2,097,952	128,934	14,021,165	12,664	2,178,208	69,300	15,939,000

[1] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[2] Includes 58 tons of zinc carbonate averaging 31.03 percent zinc.

Tenor of lead and zinc ore, old tailings, and slimes milled and concentrates produced in Oklahoma, 1944–45

	1944		1945	
	Crude ore	Old tailings and slimes	Crude ore	Old tailings and slimes
Total ore, etc., milled ... short tons	3,890,257	9,721,473	3,266,151	8,919,155
Total concentrates produced:				
Galena ... do	18,075	380	17,002	196
Sphalerite ... do	129,231	41,239	96,556	32,378
Ratio of concentrates to ore, etc.:				
Lead ... percent	0.46	0.004	0.52	0.002
Zinc ... do	3.32	.42	2.96	.36
Metal content of ore, etc.: [1]				
Lead ... do	.36	.002	.39	.001
Zinc ... do	1.99	.25	1.77	.21
Average lead content of galena concentrates ... do	77.64	51.58	75.39	51.02
Average zinc content of zinc concentrates ... do	59.97	58.47	59.98	58.94
Average value per ton:				
Galena concentrates	$123.44	$71.17	$122.60	$68.52
Zinc concentrates	108.12	99.30	110.54	103.39

[1] Figures represent metal content of the crude ore (or "dirt") only insofar as it is recovered in the concentrates; data on tailing losses not available.

The 14,000-ton Central mill of the Eagle-Picher Mining & Smelting Co. operated at less than capacity most of the year; the acute shortage of labor, besides limiting output of the mines supplying the ore, caused delays in surface transportation and handling ore at the mill. The mill is equipped with differential-density (sink-and-float) preliminary-concentration units, which furnish an enriched product for treatment by jigging and flotation. Crude ore treated in 1945 totaled 3,058,438 tons, of which 1,964,785 tons (64 percent) came from Oklahoma mines, compared with 3,433,670 tons in 1944, of which 2,213,214 tons (also 64 percent) came from Oklahoma. Eagle-Picher mines in Oklahoma shipping to the mill were the Blue Goose mines, Douthat, Goodeagle mines, Gordon No. 2, Grace Walker No. 2, Hum-bah-wat-tah mines, John Beaver No. 2, Little Greenback, Lotson, Netta, See Sah, Slim Jim, and Wesah Greenback. The company also milled a large tonnage of low-grade boulders obtained from waste dumps at various shafts in the Picher field. Other large Oklahoma shippers to the mill included the Davis Big Chief (Skelton, Lucky Bill, Imbeau), F. W. Evans (Shorthorn, Craig), Federal Mining & Smelting Co. (Lucky Syndicate-Howe, Gordon, Quapaw-Davenport), M. & M. Mining Co. (Piokee, Swift, Crawfish, White), W. M. & W. Mining Co. (Velie), Mahutska Mining Co. (Acme-Blackhawk, Cortez, Jeff City), Carpenter Mining Co. (New York-Grace Walker, Oko), Bob White Mining Co., and Mary Ann mine. The Eagle-Picher 2,400-ton Bird Dog mill was not run in 1945.

The Evans-Wallower No. 7 mine and mill were operated by Evans-Wallower Zinc, Inc., from January to August, when they were sold to the American Zinc Co. of Oklahoma, which operated them the rest of the year. The Lula Bell Mining Co. Farmington mill burned October 14, and the Farmington mine was shut down. The Beck No. 1 mill treated custom ore, mostly from the M. & W. Mining Co. Brewster-Huttig-Ninety-Six, Sequoyah, and Liza Jane (Kans.) mines. The Mission mill handled custom ore from the Pelican, Toltec, Kropp, and other mines. The United Zinc Smelting Corp. Royal mill treated company ore from the Royal and Park Walton mines and custom ore from the C. & R. and Baird leases. The Park Walton, a recently-developed mine near Melrose, was among the district's best lead producers; the 700-ton mill built at the mine began operating in February 1946. Other important-producing mine mills were the Cameron & Henderson (Admiralty mine), Kansas Explorations (Ritz), Lawyers Lead & Zinc (mine dirt and old tailings), Rialto, Scott, and Weidman (Woodchuck and Townsite mines). The St. Louis No. 4 mill treated tailings; the No. 4 mine dirt was shipped to the No. 8 (Ballard) mill in Kansas. The Four-Mile Mining Co. sank a shaft and erected a mill on the T. R. Smith land.

All the large Oklahoma tailing mills that were active in 1944 continued running throughout 1945; they comprised the Atlas, Big Chief, Britt & Britt, C. G. & C., Cardin Nos. 2, 3, and Western, Evans-Wallower No. 4, Semple (Martin), and Tri-State Zinc Ottawa and Sooner.

WISCONSIN

The Wisconsin zinc and lead district is part of the Upper Mississippi Valley region, which extends into Illinois and Iowa. The Iowa part has had no production since 1917. In 1945 the total regional output of finished (60-percent) zinc concentrates was 34,758 tons and lead concentrates 3,011 tons compared with 31,819 and 2,085 tons, respectively, in 1944. The output of recoverable zinc in 1945 (19,318 tons) was the largest since 1927 and compares with 7,956 tons in 1941, the year before the Government began paying premiums which enabled the mining of lower-grade ore. With the recent expansion of the productive area south of Galena and the general progress made in mechanizing underground operations, the region probably can support a sizable mining industry for many years if the price of and demand for zinc and lead are sufficient to warrant the mining of low-grade ore (3.5 to 4.5 percent zinc-lead content).

Since 1942 part of the crude ore produced in the region has been sold to the Metals Reserve Company and stock-piled at the Vinegar Hill Zinc Co. custom flotation mill at Cuba City, Wis. The metal output from the stock-piled ore is credited to the production of the year in which the ore is milled rather than to the year in which it is mined.

Of the total regional output in 1945, Northern Illinois contributed 6,726 tons of zinc concentrates (60-percent basis) and 648 tons of lead concentrates compared with 3,123 and 131 tons, respectively, in 1944; the yield, in terms of recoverable metals, was 3,757 tons of zinc and 485 tons of lead in 1945 compared with 1,693 and 93 tons, respectively, in 1944. Crude ore milled in 1945 totaled 125,893 tons and old tailings 24,988 tons.

The Vinegar Hill mill,[1] principal producer of finished concentrates in the region, treats crude ore and rougher jig zinc-iron-lead sulfide concentrates purchased from operators in both Wisconsin and Northern Illinois. Besides zinc and lead concentrates, the mill produces iron concentrates used in making sulfuric acid in the company plant adjoining the mill. The principal Wisconsin shippers of crude ore to the mill in 1945 were the Cuba Mining Co. (Andrews mine), Gill Bros. (James), Meloy & Baker (Hoskins, Martin), the Thompson, North Star, Piquette (Trego mine), Kittoe, Fox (Cottingham), Hofer (Boyle), Little Grant (Arensdorf & Murray), Pittsburg, and Deuce (New Harty) mining companies, Whitechurch & Farr (Little Mullen), and Harold Reinke partnership (Federal). Wisconsin shippers of rough jig concentrates to the mill were the C. F. & H. Mining Co. (Mulcahy mine), the Liberty Mining Co., and the New Lucky Hit Mining Co. (Coughlin, Wilkins).

The Dodgeville Mining Co. operated its mill at Dodgeville on ore from the Dodgeville mine (a group of city lots) until June, when the mine was cleaned up and abandoned; the mine equipment was then moved to the newly developed Simpson mine, which furnished ore for the mill the rest of the year. The W. E. Faithorn mill at New Diggings operated on ore from the reopened Champion mine. The producing tailing mills were the United Milling & Mining Co. 2,000-ton plant on the Coker property near Livingston; the Chestnut Hill Zinc Co. 200-ton mill on the Field property near Shullsburg; and the Northwest Zinc Co. new 2,000-ton mill at the Kennedy tailing pile east of Hazel Green, operated from July through December. The tailing mills together produced 4,597 tons of zinc concentrates averaging 60.93 percent zinc.

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[1] Pett, G. H., Vinegar Hill Zinc: Min. Cong. Jour., vol. 31, No. 11, November 1945, pp. 22-27.

The exploratory program of the Bureau of Mines and Geological Survey was curtailed after the Allied victory in Europe. Wisconsin zinc-lead properties drilled in 1945 included the Coker near Livingston, the Dale Rundell near Mifflin, and the Piquette, Schmitz, and Pleumer in the Tennyson area.

Mine production of lead and zinc in Wisconsin, 1941–45 [1]

Year	Lead concentrates		Zinc concentrates (sphalerite)		Metal content [2]			
					Lead		Zinc	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	1,639	$111,014	11,685	$594,323	1,225	$139,650	6,238	$935,700
1942	1,092	[3] 104,896	17,449	[3] 1,028,828	775	103,850	9,426	1,753,236
1943	1,307	[3] 111,360	26,632	[3] 1,624,858	920	138,000	14,387	3,107,592
1944	1,954	[3] 166,853	28,696	[3] 1,892,313	1,415	226,400	15,549	3,545,172
1945	2,363	[3] 210,414	28,032	[3] 2,109,877	1,776	305,472	15,561	3,579,030

[1] Most of the ore mined in Wisconsin in 1941–45 was first treated in gravity-concentration mills producing bulk concentrates which were re-treated by flotation.
[2] In calculating metal content of the ores from assays allowance has been made for smelting losses of both lead and zinc. In comparing the values of ore and metal it should be borne in mind that the value given for the ore is that actually received by the producer, whereas the value of the lead and zinc is calculated from the average price for all grades.
[3] Most of the finished zinc concentrates and part of the lead concentrates produced in Wisconsin in 1942–45 came from a custom mill treating purchased crude ores and low-grade bulk concentrates on which premium payments had been made previously to mine operators; therefore the value of these concentrates is calculated at market prices. Premium payments not reflected in the value of the finished concentrates amounted to about $399,000 in 1942, $1,059,000 in 1943, $1,384,367 in 1944, and $1,087,243 in 1945 for zinc and $18,500, $40,600, $71,498, and $96,074 respectively, for lead; part of these payments, however, were for ore which was stock-piled.

Tenor of lead and zinc ore and old tailings milled and concentrates produced in Wisconsin, 1944–45

	1944		1945	
	Crude ore	Old tailings	Crude ore	Old tailings
Total ore, etc., milled ... short tons	394,712	229,099	338,033	619,644
Total concentrates produced: [1]				
Lead ... do	1,954	----------	2,363	----------
Zinc ... do	26,421	2,275	23,435	4,597
Ratio of concentrates to ore, etc.: [2]				
Lead ... percent	0.50	----------	0.70	----------
Zinc ... do	6.69	0.99	6.93	0.74
Metal content of ore, etc.: [3]				
Lead ... do	.37	----------	.54	----------
Zinc ... do	4.04	.59	4.29	.45
Average lead content of galena concentrates ... do	74.00	----------	76.77	----------
Average zinc content of sphalerite concentrates ... do	60.31	58.99	61.83	60.93
Average value per ton: [4]				
Galena concentrates	$85.39	----------	$89.05	----------
Sphalerite concentrates	63.35	$96.07	64.19	$131.73

[1] Most of the ore mined in Wisconsin in 1944–45 was first treated in gravity-concentration mills producing bulk concentrates which were re-treated by flotation.
[2] Percentage represents finished flotation concentrates.
[3] Percentages represent metal content of the ore insofar as it is recovered in the concentrates.
[4] Most of the finished zinc concentrates and part of the lead concentrates produced in Wisconsin in 1944–45 came from a custom mill treating purchased crude ores and low-grade bulk concentrates on which premium payments had been made previously to mine operators; therefore, the value of these concentrates is calculated at market prices.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN COLORADO

(MINE REPORT)

By G. E. Woodward and S. A. Gustavson

SUMMARY OUTLINE

SUMMARY

Despite the rescission of Limitation Order L–208 by the War Production Board, effective July 1, Colorado gold output in 1945 was the smallest since 1873 and silver production the lowest since 1873 except for 1931–33. Output of both lead and zinc decreased in 1945, but copper output gained. A substantial increase in output of placer gold was due to operation resumed by a floating connected-bucket dredge in Park County.

Colorado mines in 1945 yielded, in terms of recoverable metals, 100,935 fine ounces of gold, 2,226,780 ounces of silver, 2,970,000 pounds of copper, 34,088,000 pounds of lead, and 71,546,000 pounds of zinc, the total valued at $16,676,521, a 6-percent decrease compared with 1944. Comparing 1945 with 1944, gold decreased 9 percent and silver 1 percent in both quantity and value; copper increased 42 percent in quantity and value; lead decreased 4 percent in quantity but increased 4 percent in value; zinc decreased 10 percent in quantity and value. Of the total value of these five metals, zinc represented 49 percent, gold 21 percent, lead 18 percent, silver 10 percent, and copper 2 percent.

Eagle County continued to rank first in value of production of the five metals and was first in production of zinc. Lake County was again second in value of production of these five metals, first in production of lead, and second in zinc. San Juan ranked third; San Miguel, fourth; and Dolores, fifth. These five counties, each producing over $1,000,000 in value of the five metals, accounted for 72 percent of the State total value.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Annual figures for the 5 years ended with 1945 and total production from 1858 are given in the table that follows. Colorado is second in the production of silver and gold, having yielded first place in the production of silver to Montana in 1942; California is the leading gold producer.

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1941–45, and total, 1858–1945, in terms of recovered metals

Year	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	579	324	2,222,786	380,029	$13,301,015	7,301,697	$5,192,318
1942	311	68	1,797,386	268,627	9,401,945	3,096,211	2,201,750
1943	235	17	1,631,318	137,558	4,814,530	2,664,142	1,894,501
1944	196	13	1,550,422	111,455	3,900,925	2,248,830	1,599,168
1945	195	41	1,357,551	100,935	3,532,725	2,226,780	1,583,488
1858–1945	-----------	-----------	(1)	38,915,330	855,913,514	728,186,527	565,760,083

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	13,496,000	$1,592,528	25,148,000	$1,433,436	31,444,000	$2,358,300	$23,877,597
1942	2,204,000	266,684	30,362,000	2,034,254	64,430,000	5,991,990	19,896,623
1943	2,056,000	267,280	36,064,000	2,704,800	88,188,000	9,524,304	19,205,415
1944	2,096,000	282,960	35,396,000	2,831,680	79,910,000	9,109,740	17,724,473
1945	2,970,000	400,950	34,088,000	2,931,568	71,546,000	8,227,790	16,676,521
1858–1945	[2] 248,957	65,717,073	[2] 2,444,846	235,198,015	[2] 1,303,051	194,440,520	1,917,029,205

[1] Figures not available. [2] Short tons.

Gold and silver produced at placer mines in Colorado, 1941–45, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Dredges						Total	
			Dry-land [1]		Dragline floating		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1941	1,886	402	13,052	2,580	4,817	553	10,622	2,152	30,377	5,687
1942	1,802	335	119	9	6,173	945	14,523	2,913	22,617	4,202
1943	521	90	-------	-------	-------	-------	-------	-------	521	90
1944	343	90	-------	-------	-------	-------	-------	-------	343	90
1945	605	118	-------	-------	-------	-------	7,296	1,277	7,901	1,395

[1] Dragline and power-shovel excavators with sluices or special amalgamators.

Gold.—Colorado mines yielded 100,935 ounces of gold in 1945 compared with 111,455 ounces in 1944. The principal gold-producing districts were: Cripple Creek in Teller County, which produced 28 percent of the State total gold output; Animas in San Juan County, 22 percent; Upper San Miguel in San Miguel County, 18 percent; California (Leadville) in Lake County, 16 percent; Fairplay in Park County, 7 percent; and Sneffels in Ouray County, 3 percent. Dry and siliceous ores yielded 73 percent of the State total gold; zinc-lead ore, 17 percent; placers, 8 percent; and copper, lead, zinc, zinc-copper, and zinc-lead-copper, 2 percent.

Silver.—The output of silver decreased from 2,248,830 ounces in 1944 to 2,226,780 ounces in 1945. The leading silver-producing districts were: Creede in Mineral County, which produced over 19 percent of the State total silver; California (Leadville) in Lake County, slightly less than 19 percent; Animas in San Juan County, 14 percent; Upper San Miguel in San Miguel County, 12 percent; Pioneer (Rico) in Dolores County, 7 percent; and Sneffels in Ouray County, 4 percent. Dry and siliceous ores yielded 52 percent of the total State silver; zinc-lead ore, 41 percent; and copper, lead, zinc-lead-copper ores, and placers, 7 percent.

Copper.—The output of recovered copper from mines in Colorado in 1945 was 2,970,000 pounds compared with 2,096,000 pounds in 1944. Most of the copper produced in Colorado is recovered as a byproduct from ores mined for their zinc, lead, or precious metal content; the exceptions are the ores from the Cashin mine in Montrose County and the Idarado Mining Co. in San Miguel County—the latter makes a copper concentrate from its complex gold-silver-copper-lead-zinc ore. Dry and siliceous gold ores yielded 56 percent of the total State copper; zinc-lead ore, 24 percent; copper ore, 16 percent; and lead, zinc, zinc-copper, and zinc-lead-copper ores, 4 percent.

Lead.—The mine production of recovered lead in Colorado was 34,088,000 pounds in 1945 compared with 35,396,000 pounds in 1944. The Leadville district, Lake County, continued to be the largest lead-

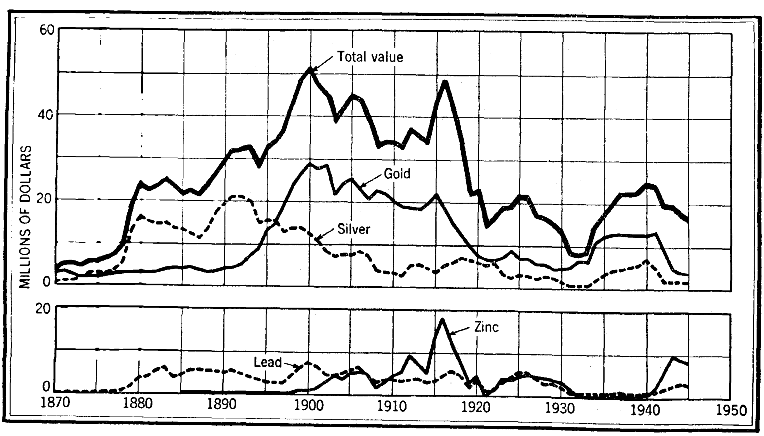

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Colorado, 1870–1945. The value of copper has been less than $2,000,000 annually, except in a few years.

producing area in the State, followed by the Animas in San Juan County, Pioneer (Rico) in Dolores County, Upper San Miguel in San Miguel County, Ten Mile in Summit County, and Red Cliff in Eagle County. Each of these districts produced over 1,000,000 pounds and combined accounted for 78 percent of the lead produced in the State in 1945. Zinc-lead ore yielded 64 percent of the State total; siliceous ores, 27 percent; and copper, lead, zinc, and zinc-lead-copper, 9 percent.

Zinc.—The output of recovered zinc from mines in Colorado decreased from 79,910,000 pounds in 1944 to 71,546,000 pounds in 1945. The principal zinc-producing districts in 1945, in order of output, were: Red Cliff, California (Leadville), Pioneer (Rico), Ten Mile, Upper San Miguel, Animas, Breckenridge, Griffith, Tomichi, and Kerber Creek; these 10 districts produced 94 percent of the State total output in 1945. Zinc, zinc-lead, and zinc-lead-copper ores yielded 93 percent of the State total zinc and dry and siliceous ores 7 percent.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1945, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Adams	----------	3	319	$11,165	52	$37
Boulder	17	----------	603	21,105	6,487	4,613
Chaffee	2	----------	38	1,330	3,029	2,154
Clear Creek	23	2	899	31,465	106,304	75,594
Costilla	----------	1	2	70	----------	----------
Custer	6	----------	115	4,025	18,097	12,869
Dolores	3	----------	157	5,495	152,266	108,278
Eagle	1	----------	117	4,095	49,171	34,966
Fremont	3	----------	115	4,025	6,047	4,300
Gilpin	10	15	257	8,995	2,835	2,016
Gunnison	6	----------	63	2,205	27,201	19,343
Hinsdale	1	----------	2	70	332	236
Jefferson	----------	5	55	1,925	14	10
Lake	26	----------	15,713	549,955	417,517	296,901
La Plata	2	----------	75	2,625	90	64
Mineral	6	----------	238	8,330	433,177	308,037
Montrose	1	1	30	1,050	12,278	8,731
Ouray	10	----------	3,126	109,410	176,926	125,814
Park	8	6	8,538	298,830	11,340	8,064
Pitkin	5	----------	----------	----------	78,362	55,724
Rio Grande	1	----------	560	19,600	675	480
Routt	1	----------	4	140	696	495
Saguache	6	----------	76	2,660	47,302	33,637
San Juan	12	----------	21,923	767,305	306,374	217,866
San Miguel	7	2	17,780	622,300	274,559	195,242
Summit	19	6	1,606	56,210	94,652	67,308
Teller	19	----------	28,524	998,340	997	709
	195	41	100,935	3,532,725	2,226,780	1,583,488
Total, 1944	196	13	111,455	3,900,925	2,248,830	1,599,168

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1945, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Adams							$11,202
Boulder	10,000	$1,350	163,000	$14,018	17,000	$1,955	43,041
Chaffee	6,000	810	24,000	2,064	326,000	37,490	43,848
Clear Creek	28,000	3,780	1,542,000	132,612	1,425,000	163,875	407,326
Costilla							70
Custer	4,000	540	397,000	34,142	323,000	37,145	88,721
Dolores	172,000	23,220	4,880,000	419,680	7,840,000	901,600	1,458,273
Eagle	16,000	2,160	1,143,000	98,298	31,610,000	3,635,150	3,774,669
Fremont	48,000	6,480	99,000	8,514	787,000	90,505	113,824
Gilpin	5,600	756	90,000	7,740	46,000	5,290	24,797
Gunnison	20,000	2,700	969,000	83,334	869,000	99,935	207,517
Hinsdale	3,000	405					711
Jefferson							1,935
Lake	344,000	46,440	10,033,000	862,838	14,838,000	1,706,370	3,462,504
La Plata							2,689
Mineral	69,400	9,369	605,000	52,030	9,000	1,035	378,801
Montrose	392,000	52,920					62,701
Ouray	168,000	22,680	1,791,000	154,026	1,144,000	131,560	543,490
Park	36,000	4,860	102,000	8,772	764,000	87,860	408,386
Pitkin			336,000	28,896	201,000	23,115	107,735
Rio Grande	2,400	324					20,404
Routt	3,600	486	14,000	1,204	126,000	14,490	16,815
Saguache	114,000	15,390	599,000	51,514	782,000	89,930	193,131
San Juan	466,000	62,910	5,371,000	461,906	1,690,000	194,350	1,704,337
San Miguel	1,042,000	140,670	3,971,000	341,506	2,915,000	335,225	1,634,943
Summit	20,000	2,700	1,959,000	168,474	5,834,000	670,910	965,602
Teller							999,049
	2,970,000	400,950	34,088,000	2,931,568	71,546,000	8,227,790	16,676,521
Total, 1944	2,096,000	282,960	35,396,000	2,831,680	79,910,000	9,109,740	17,724,473

Ore sold or treated and gold and silver produced at lode mines in Colorado in 1945, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Boulder	23,091	603	6,487
Chaffee	1,459	38	3,029
Clear Creek	18,022	896	106,304
Custer	4,689	115	18,097
Dolores	36,215	157	152,266
Eagle	137,996	117	49,171
Fremont	5,147	115	6,047
Gilpin	928	183	2,821
Gunnison	6,534	63	27,201
Hinsdale	8	2	332
Lake	473,818	15,713	417,517
La Plata	4	75	90
Mineral	18,354	238	433,177
Montrose	6,587	27	12,278
Ouray	33,976	3,126	176,926
Park	9,034	1,177	10,049
Pitkin	18,518		78,362
Rio Grande	948	560	675
Routt	494	4	696
Saguache	7,030	76	47,302
San Juan	196,106	21,923	306,374
San Miguel	184,999	17,761	274,552
Summit	43,824	1,541	94,635
Teller	129,770	28,524	997
	1,357,551	93,034	2,225,385
Total, 1944	1,550,422	111,112	2,248,740

Mine production of gold, silver, copper, lead, and zinc in Colorado, 1945, by months, in terms of recovered metal

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	9,024	161,458	286,000	2,396,000	6,348,000
February	9,104	177,877	260,000	2,530,000	5,902,000
March	10,174	228,332	350,000	3,182,000	6,998,000
April	8,081	183,558	212,000	2,616,000	5,558,000
May	10,357	200,132	212,000	2,804,000	5,596,000
June	9,047	178,822	246,000	2,868,000	5,778,000
July	8,210	181,315	238,000	2,878,000	6,398,000
August	7,129	202,877	310,000	3,184,000	6,434,000
September	6,306	201,347	250,000	2,774,000	6,212,000
October	7,659	170,229	194,000	3,226,000	4,346,000
November	7,742	190,306	204,000	3,068,000	6,894,000
December	8,102	150,527	208,000	2,562,000	5,082,000
	100,935	2,226,780	2,970,000	34,088,000	71,546,000

Gold and silver produced at placer mines in Colorado in 1945, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Floating bucket dredges		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Adams	319	52			319	52
Clear Creek	3				3	
Costilla	2				2	
Gilpin	74	14			74	14
Jefferson	55	14			55	14
Montrose	3				3	
Park	65	14	7,296	1,277	7,361	1,291
San Miguel	19	7			19	7
Summit	65	17			65	17
	605	118	7,296	1,277	7,901	1,395
Total, 1944	343	90			343	90

MINING INDUSTRY

The nonferrous metal-mining industry in Colorado in 1945 was affected by several factors. Among the more favorable factors were: The continued successful development of the Black Bear vein in San Miguel County by the Idarado Mining Co., which has not only demonstrated greater depth of the mineral deposits in the San Juan region (Ouray, San Juan, San Miguel Counties) but has added a substantial tonnage of copper-zinc-lead ores to the State reserves; the successful developments at the Telluride Mines, Inc., property in the Upper San Miguel district, which have prompted the company to begin work on a new tunnel to open the mine at greater depth; the milling program of the American Smelting & Refining Co. at Leadville, which has stimulated the mining of base-metal ores in Lake and adjacent counties; and the resumption of placer mining in Park County on a large scale. The greatest deterrent to a larger output of ores from Colorado mines and the pursuit of more vigorous development in the mines was the extreme shortage of manpower. The shortage was more severe during the first 10 months of 1945 than in any other period during the war. The shortage of equipment and supplies was also evident in the postponement of the development programs at several mines throughout the State. Some relief from this labor shortage was noted during November and December 1945.

In June 1945 Congress passed legislation permitting continuation of the Premium Price Plan for copper, lead, and zinc until June 30, 1946. The plan was extended on about the same conditions as heretofore and included the noncancellation requirement, meaning that all classes of premiums shall be noncancellable unless necessary to make individual adjustments of income to specific mines. On June 16 the War Production Board announced revocation of its Limitation Order L-208, effective July 1, 1945.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Colorado in 1945, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	432,028	61,833	264,025	346,174	4,631,780	1,984,400
Dry and siliceous gold-silver ore	120,963	11,675	340,787	1,199,349	3,218,987	2,738,700
Dry and siliceous silver ore	74,532	265	563,844	111,646	1,504,291	195,400
	627,523	73,773	1,168,656	1,657,169	9,355,058	4,918,500
Copper ore	7,230	92	23,017	465,552	44,341	
Lead ore	7,229	1,087	55,048	14,824	1,570,506	
Zinc ore	151,998	1,018	69,317	79,391	1,357,035	34,714,600
Zinc-copper ore	1,090	7		5,600		54,400
Zinc-lead ore	561,782	17,017	907,116	725,526	21,718,991	31,797,500
Zinc-lead-copper ore	699	40	2,231	21,938	42,069	61,000
	730,028	19,261	1,056,729	1,312,831	24,732,942	66,627,500
Total, lode mines	1,357,551	93,034	2,225,385	2,970,000	34,088,000	71,546,000
Total, placers		7,901	1,395			
	1,357,551	100,935	2,226,780	2,970,000	34,088,000	71,546,000
Total, 1944	1,550,422	111,455	2,248,830	2,096,000	35,396,000	79,910,000

METALLURGIC INDUSTRY

Of the 1,357,551 tons of ore mined in 1945 in Colorado, 784,093 tons (58 percent) were treated at concentrating mills and 544,450 tons (40 percent) at amalgamation and cyanidation mills with concentrating equipment; 29,008 tons (2 percent) were shipped crude to smelters. Colorado has no zinc smelters, consequently all zinc concentrates produced were shipped out of the State; markets for these concentrates were had at Amarillo and Dumas, Tex., Depue, Ill., Palmerton, Pa., and Anaconda and Great Falls, Mont. The Arkansas Valley lead bullion-leady copper matte smelter at Leadville purchased most of the siliceous gold-silver and lead concentrates and silver, lead-copper, and lead ores shipped to smelters during the year; the Golden Cycle mill at Colorado Springs offered a market for nearly all the gold ores shipped for treatment. Smelters and custom mills in the Salt Lake Valley, Utah, became increasingly important as a market for zinc-lead ores and concentrates.

Mine production of metals in Colorado in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore and concentrates amalgamated [1]	197,919	11,386	2,390			
Sands and slimes cyanided [2]	[3] 209,888	24,203	16,466	----------	----------	----------
Concentrates smelted	129,138	55,182	2,093,481	2,449,214	31,971,051	71,509,400
Ore smelted	29,008	2,263	113,048	520,786	2,116,949	36,600
Placer [1]	----------	7,901	1,395	----------	----------	----------
	----------	100,935	2,226,780	2,970,000	34,088,000	71,546,000
Total, 1944	----------	111,455	2,248,830	2,096,000	35,396,000	79,910,000

[1] Quicksilver used by amalgamation mills was approximately 1,314 pounds. Placer mines used approximately 81 pounds.
[2] Cyanide (in terms of 96 to 98 percent NaCN) used was 179,970 pounds.
[3] Comprises 131,076 tons of sands and slimes from ore first roasted and amalgamated and 78,812 tons of selective-flotation tailings.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Colorado in 1945, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	1,849	424	136	41	101	583	100	15,400	17,000
Chaffee	1,459	11	138	418	27	2,891	6,000	24,000	326,000
Clear Creek	3,938	193	561	670	294	8,441	6,703	268,442	258,200
Custer	3,440	36	597	517	69	9,104	3,878	161,183	271,600
Fremont	5,046	35	312	1,050	69	4,942	46,400	87,000	772,000
Gilpin	87	16	12	14	36	198	3,328	1,365	3,400
Gunnison	2,231	12	144	454	24	2,192	6,131	152,223	202,300
Lake	357,922	1,339	13,187	13,216	2,691	213,825	205,072	2,518.339	6,627,200
Ouray	25,947	1,658	472	2,249	1,305	96,091	123,000	884,000	722,400
Pitkin	4,825	--------	69	85	--------	1,046	--------	26,349	41,000
Rio Grande	948	271	6	96	289	669	2,400	--------	--------
Saguache	199	1	25	54	2	387	851	11,573	32,000
San Juan	2,209	25	633	608	50	9,650	10,769	247,653	230,800
San Miguel	28	[1] 2,968	[1] 1,481	--------	--------	--------	--------	--------	--------
Summit	4,552	76	86	660	150	1,298	7,507	255,077	265,200
Teller	129,770	28,524	997	--------	--------	--------	--------	--------	--------
	544,450	35,589	18,856	20,132	5,107	351,317	422,139	4,652,604	9,769,100
Total, 1944	890,913	42,311	23,923	40,428	21,854	600,609	548,101	8,500,446	15,438,184

BY CLASSES OF ORE TREATED

Dry and siliceous gold	171,801	32,812	2,715	2,145	1,629	16,611	15,042	93,715	70,800
Dry and siliceous gold-silver	26,160	1,683	557	2,254	1,312	96,316	123,430	885,947	724,100
Dry and siliceous silver	4,825	--------	69	85	--------	1,046	--------	26,349	41,000
Copper	65	16	10	8	35	163	3,328	--------	--------
Zinc	5,599	43	472	1,352	95	8,125	47,600	91,075	1,023,000
Zinc-lead	336,000	1,035	15,033	14,288	2,036	229,056	232,739	3,555,518	7,910,200
	544,450	35,589	18,856	20,132	5,107	351,317	422,139	4,652,604	9,769,100

[1] Includes 2,915 ounces of gold and 1,459 ounces of silver recovered from amalgamating 159 tons of concentrates caught in gold trap of flotation mill.

The quantity of siliceous ores sold or treated decreased from 640,864 tons in 1944 to 627,523 in 1945 and all base metal ores from 909,558 to 730,028. Of the ore treated at concentrating plants, 258,449 tons were gold ore, 225,588 tons zinc-lead ore, 146,399 tons zinc ore, 94,353 tons gold-silver ore, 55,725 tons silver ore, and 3,579 tons lead, zinc-copper, and zinc-lead-copper. The classification of ores treated at the Golden Cycle mill, the only amalgamation-cyanidation-concentration mill active in Colorado in 1945, is discussed under El Paso and Teller Counties.

The destination and treatment of concentrates and ore produced by operators in the State are discussed in the following review by counties and districts.

By far the greater part of the placer gold and silver produced in 1945 came from a connected-bucket dredge in Park County; the remainder was recovered largely by hand-sluicing methods, and no accurate data on the yardage treated are obtainable.

Mine production of metals from concentrating mills in Colorado in 1945, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	21, 046	167	5	4, 111	6, 544	110, 680	----------
Clear Creek	14, 016	2, 661	378	95, 934	20, 937	1, 258, 265	1, 159, 800
Custer	435	97	5	1, 509	122	31, 675	51, 400
Dolores	36, 215	12, 132	157	152, 266	172, 000	4, 880, 000	7, 840, 000
Eagle	137, 502	37, 267	90	43, 624	2, 292	1, 139, 500	31, 610, 000
Gilpin	742	181	97	2, 018	1, 706	80, 581	42, 600
Gunnison	4, 034	1, 794	24	20, 050	13, 869	583, 777	666, 700
Lake	97, 819	16, 709	10, 042	134, 832	108, 956	6, 330, 052	8, 210, 800
Mineral	18, 006	1, 769	121	432, 396	69, 400	507, 686	9, 000
Ouray	7, 858	1, 437	161	77, 829	45, 000	827, 746	421, 600
Park	8, 965	1, 970	1, 070	9, 831	30, 535	100, 799	764, 000
Pitkin	12, 927	420	----------	73, 413	----------	266, 349	145, 400
Routt	494	152	4	696	3, 600	14, 000	126, 000
Saguache	6, 124	2, 031	59	34, 207	42, 939	473, 666	750, 000
San Juan	193, 803	8, 133	21, 845	294, 894	454, 682	5, 105, 745	1, 459, 200
San Miguel	184, 971	13, 949	14, 793	273. 071	1, 042, 000	3, 971, 000	2, 915, 000
Summit	39, 136	8, 137	1, 224	91, 483	12, 493	1, 636, 926	5, 568, 800
	784, 093	109, 006	50, 075	1, 742, 164	2, 027. 075	27, 318, 447	61, 740, 300
Total, 1944	624, 696	102, 428	42, 618	1, 427, 781	961, 379	24, 316, 748	64, 337, 192

BY CLASSES OF ORE TREATED

	Ore treated (short tons)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	258, 449	13, 523	26, 465	237, 776	323, 443	4, 456, 458	1, 913, 600
Dry and siliceous gold-silver	94. 353	6, 000	8, 605	241, 289	1, 072, 988	2, 298, 805	2, 014, 600
Dry and siliceous silver	55, 725	2, 464	139	521, 475	76, 533	919, 201	154, 400
Lead	1, 790	183	11	16, 202	2, 355	202, 021	----------
Zinc	146, 399	40, 422	880	60, 720	31, 791	1, 265, 960	33, 691, 600
Zinc-copper	1, 090	70	7	----------	5, 600	----------	54, 400
Zinc-lead	225, 588	46, 142	13, 928	662, 471	492, 427	18, 133, 933	23, 850, 700
Zinc-lead-copper	699	202	40	2, 231	21, 938	42, 069	61, 000
	784, 093	109, 006	50, 075	1, 742, 164	2, 027, 075	27, 318, 447	61, 740, 300

Gross metal content of concentrates produced from ores mined in Colorado in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (wet assay) (pounds)	Lead (wet assay) (pounds)	Zinc (pounds)
Dry gold	2, 804	2, 246	20, 035	21, 841	141, 689	317, 651
Copper	1, 467	2, 788	43, 030	740, 552	133, 715	112, 680
Lead	33. 497	32, 911	1, 499, 160	780, 346	26, 778, 366	4, 096, 855
Lead-copper	5, 431	12, 879	241, 389	657, 917	3, 708, 868	607, 410
Dry iron (from zinc-lead ore)	2, 161	112	8, 724	15, 938	114, 338	189, 086
Total to copper and lead plants	45, 360	50, 936	1, 812, 338	2, 216, 594	30, 876, 976	5, 323, 682
Zinc	80, 564	3, 951	240, 969	522, 884	2. 027, 954	79, 369, 092
Zinc-copper	128	13	331	14, 383	3, 569	126, 485
Zinc-lead	674	271	18, 301	15, 163	179, 890	399, 328
Zinc-lead-copper	2, 412	1, 313	97, 245	156, 588	922, 480	1, 147, 915
Total to zinc plants	83. 778	5, 548	356, 846	709, 018	3, 133, 893	81, 042, 820
	129, 138	56, 484	2, 169, 184	2, 925, 612	34, 010, 869	86, 366, 502
Total, 1944	142, 856	65, 705	2, 097, 396	1, 937, 780	36, 798. 597	95, 693, 416

Mine production of metals from Colorado concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	208	106	4, 694	6, 644	126, 080	17, 000
Chaffee	418	27	2, 891	6, 000	24, 000	326, 000
Clear Creek	3, 331	672	104, 375	27, 640	1, 526, 707	1, 418, 000
Custer	614	74	10, 613	4, 000	192, 858	323, 000
Dolores	12, 132	157	152, 266	172, 000	4, 880, 000	7, 840, 000
Eagle	37, 267	90	43, 624	2, 292	1, 139, 500	31, 610, 000
Fremont	1, 050	69	4, 942	46, 400	87, 000	772, 000
Gilpin	195	133	2, 216	5, 034	81, 946	46, 000
Gunnison	2, 248	48	22, 242	20, 000	736, 000	869, 000
Lake	29, 925	12, 733	348, 657	314, 028	8, 848, 391	14, 838, 000
Mineral	1, 769	121	432, 396	69, 400	507, 686	9, 000
Ouray	3, 686	1, 466	173, 920	168, 000	1, 711, 746	1, 144, 000
Park	1, 970	1, 070	9, 831	30, 535	100, 799	764, 000
Pitkin	505	-----	74, 459	-----	292, 698	186, 400
Rio Grande	96	289	669	2, 400	-----	-----
Routt	152	4	696	3, 600	14, 000	126, 000
Saguache	2, 085	61	34, 594	43, 790	485, 239	782, 000
San Juan	8, 741	21, 895	304, 544	465, 451	5, 353, 398	1, 690, 000
San Miguel	13, 949	14, 793	273, 071	1, 042, 000	3, 971, 000	2, 915, 000
Summit	8, 797	1, 374	92, 781	20, 000	1, 892, 003	5, 834, 000
	129, 138	55, 182	2, 093, 481	2, 449, 214	31, 971, 051	71, 509, 400
Total, 1944	142, 856	64, 472	2, 028, 390	1, 509, 480	32, 817, 194	79, 775, 376

BY CLASSES OF CONCENTRATES SMELTED

Dry gold	2, 804	2, 246	20, 035	17, 735	135, 906	-----
Copper	1, 467	2, 788	43, 030	725, 483	80, 229	-----
Lead	33, 497	32, 911	1, 499, 160	620, 413	25, 711, 527	14, 700
Lead-copper	5, 431	12, 879	241, 389	524, 205	3, 561, 114	-----
Dry iron (from zinc-lead ore)	2, 161	112	8, 724	11, 757	100, 085	-----
Total to copper and lead plants	45, 360	50, 936	1, 812, 338	1, 899, 593	29, 588, 861	14, 700
Zinc	80, 564	2, 668	165, 871	391, 826	1, 309, 265	70, 167, 700
Zinc-copper	128	13	321	11, 816	2, 937	110, 400
Zinc-lead	674	252	17, 706	12, 009	164, 337	347, 600
Zinc-lead-copper	2, 412	1, 313	97, 245	133, 970	905, 651	869, 000
Total to zinc plants	83, 778	4, 246	281, 143	549, 621	2, 382, 190	71, 494, 700
	129, 138	55, 182	2, 093, 481	2, 449, 214	31, 971, 051	71, 509, 400

Gross metal content of Colorado crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	1,778	927	6,923	9,656	85,072	----------
Dry and siliceous gold-silver ore	450	75	2,625	3,839	35,661	----------
Dry and siliceous silver ore	13,982	126	41,254	43,468	582,069	----------
Copper ore	7,165	41	22,844	470,955	73,902	----------
Lead ore	5,439	1,076	38,846	16,272	1,426,869	----------
Total to copper and lead plants	28,814	2,245	112,492	544,190	2,203,573	----------
Zinc-lead ore	194	18	556	596	32,608	47,570
Total to zinc plants	194	18	556	596	32,608	47,570
	29,008	2,263	113,048	544,786	2,236,181	47,570
Total, 1944	34,813	4,329	196,427	624,230	2,857,339	303,084

Mine production of metals from Colorado crude ore shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Boulder	196	73	1,657	3,356	36,920	----------
Clear Creek	68	31	1,368	360	15,293	7,000
Custer	814	5	6,887	----------	204,142	----------
Eagle	494	27	5,547	13,708	3,500	----------
Fremont	101	11	793	1,600	12,000	15,000
Gilpin	99	34	593	566	8,054	----------
Gunnison	269	3	4,815	----------	233,000	----------
Hinsdale	8	2	332	3,000	----------	----------
Lake	18,077	1,641	55,673	29,972	1,184,609	----------
La Plata	4	75	90	----------	----------	----------
Mineral	348	117	781	----------	97,314	----------
Montrose	6,587	27	12,278	392,000	----------	----------
Ouray	171	2	2,534	----------	79,254	----------
Park	69	107	218	5,465	1,201	----------
Pitkin	766	----------	3,834	----------	43,302	14,600
Saguache	707	14	12,683	70,210	113,761	----------
San Juan	94	3	1,197	549	17,602	----------
Summit	136	91	1,768	----------	66,997	----------
	29,008	2,263	113,048	520,786	2,116,949	36,600
Total, 1944	34,813	4,329	196,427	586,520	2,578,806	134,624

BY CLASSES OF ORE

Dry and siliceous gold ore	1,778	927	6,923	7,689	81,607	----------
Dry and siliceous gold-silver ore	450	75	2,625	2,931	34,235	----------
Dry and siliceous silver ore	13,982	126	41,254	35,113	558,741	----------
Copper ore	7,165	41	22,844	462,224	44,341	----------
Lead ore	5,439	1,076	38,846	12,469	1,368,485	----------
Total to copper and lead plants	28,814	2,245	112,492	520,426	2,087,409	----------
Zinc-lead ore	194	18	556	360	29,540	36,600
Total to zinc plants	194	18	556	360	29,540	36,600
	29,008	2,263	113,048	520,786	2,116,949	36,600

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Adams County		3			319	319		52	52				$11,202
Boulder County:													
Central (Jamestown)	3		21,170	18		18	4,884		4,884	8,400	147,000		17,879
Gold Hill	6		1,469	338		338	997		997	1,000	11,100	14,000	15,239
Grand Island	1		10				471		471		200		352
Sugar Loaf	5		414	202		202	83		83		4,300	3,000	7,844
Ward	2		28	45		45	52		52	600	400		1,727
Chaffee County:													
Granite	1		5	2		2	1		1				71
Monarch	1		1,454	36		36	3,028		3,028	6,000	24,000	326,000	43,777
Clear Creek County:													
Alice	1		1	5		5	17		17		200		204
Argentine	1		2,495	153		153	2,084		2,084	2,400	224,500	59,400	33,299
Cascade	1		7	1		1	391		391		400		347
Empire	3		42	16		16	367		367		8,500	4,000	2,012
Griffith	6		6,673	67		67	75,524		75,524	10,000	933,000	1,037,000	256,894
Idaho Springs	8	2	3,983	351	3	354	10,873		10,873	11,600	154,600	202,200	58,237
Montana	1		4,179	26		26	13,621		13,621	1,400	88,300	51,800	24,336
Trail	2		642	277		277	3,427		3,427	2,600	132,500	70,600	31,997
Costilla County: Grayback		1			2	2							70
Custer: Hardscrabble	6		4,689	115		115	18,097		18,097	4,000	397,000	323,000	88,721
Dolores County: Pioneer	3		36,215	157		157	152,266		152,266	172,000	4,880,000	7,840,000	1,458,273
Eagle County: Red Cliff	1		137,996	117		117	49,171		49,171	16,000	1,143,000	31,610,000	3,774,669
Fremont County:													
Arkansas River	1		101	11		11	793		793	1,600	12,000	15,000	3,922
Cotopaxi	1		3,862	84		84	5,119		5,119	41,600	64,000	664,000	94,060
Grape Creek	1		1,184	20		20	135		135	4,800	23,000	108,000	15,842
Gilpin County:													
Southern	9	15	926	181	74	255	2,821	14	2,835	5,600	90,000	46,000	24,727
Northern	1		2	2		2							70
Gunnison County:													
Elk Mountain	1		2	2		2	232		232				235
Rock Creek	1		89				180		180	1,600	6,400	8,600	1,883
Taylor Park	2		267	1		1	4,583		4,583		233,000		23,332
Tomichi	2		6,176	60		60	22,206		22,206	18,400	729,600	860,400	182,067
Hinsdale County: Lake	1		8	2		2	332		332	3,000			711
Jefferson County		5			55	55		14	14				1,935

Mine production of gold, silver, copper, lead, and zinc in Colorado in 1945, by counties and districts, in terms of recovered metals—Con.

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Lake County:													
California (Leadville)	25		473,812	15,706		15,706	417,427		417,427	344,000	10,032,000	14,838,000	$3,462,109
St. Kevin	1		6	7		7	90		90		1,000		395
La Plata County: California (La Plata)	2		4	75		75	90		90				2,689
Mineral County: Creede	6		18,354	238		238	433,177		433,177	69,400	605,000	9,000	378,801
Montrose County:													
La Sal	1		6,587	27		27	12,278		12,278	392,000			62,596
San Miguel River		1			3	3							105
Ouray County:													
Red Mountain	6		1,586	74		74	8,325		8,325	28,000	282,500	177,600	57,009
Sneffels	1		25,947	2,963		2,963	96,563		96,563	123,000	884,000	722,400	348,077
Uncompahgre	3		6,443	89		89	72,038		72,038	17,000	624,500	244,000	138,404
Park County:													
Alma Placers		2			4	4		1	1				141
Beaver Creek		1			19	19		6	6				669
Buckskin	4		6,536	1,041		1,041	9,682		9,682	24,600	98,400	707,000	136,408
Fairplay		3			7,338	7,338		1,284	1,284				257,743
Freshwater	2		64	1		1	83		83	5,600	100	2,600	1,158
Mosquito	1		1,344	128		128	284		284	200	3,500		5,010
Pulver	1		1,090	7		7				5,600		54,400	7,257
Pitkin County: Roaring Fork	5		18,518				78,362		78,362		336,000	201,000	107,735
Rio Grande County: Summitville	1		948	560		560	675		675	2,400			20,404
Routt County	1		494	4		4	696		696	3,600	14,000	126,000	16,815
Saguache County: Kerber Creek	6		7,030	76		76	47,302		47,302	114,000	599,000	782,000	193,131
San Juan County:													
Animas	7		194,862	21,870		21,870	301,957		301,957	453,400	5,225,000	1,590,200	1,673,607
Eureka	4		1,062	39		39	2,915		2,915	10,600	117,500	86,800	24,956
Ice Lake Basin	1		182	14		14	1,502		1,502	2,000	28,500	13,000	5,774
San Miguel County:													
Iron Springs	1		3	1		1							35
Upper San Miguel	6	2	184,996	17,760	19	17,779	274,552	7	274,559	1,042,000	3,971,000	2,915,000	1,634,908
Summit County:													
Breckenridge	4		6,910	354	65	419	8,633	17	8,650	14,800	297,100	1,445,000	214,540
Green Mountain	1		169	1		1	696		696		1,500	51,200	6,547
Montezuma	8		2,542	11		11	18,083		18,083	5,000	299,900	54,000	45,920
Ten Mile (Kokomo, Robinson)	6	6	34,203	1,175		1,175	67,223		67,223	200	1,360,500	4,283,800	698,595
Teller County: Cripple Creek	19		129,770	28,524		28,524	997		997				999,049
Total Colorado	195	41	1,357,551	93,034	7,901	100,935	2,225,385	1,395	2,226,780	2,970,000	34,088,000	71,546,000	16,676,521

ADAMS COUNTY

Sand and gravel handled in the washing plants by three operators on Clear Creek and the Platte River yielded gold as a byproduct in sluices operated by lessees.

BOULDER COUNTY

Central (Jamestown) district.—Nearly all the gold, silver, copper, and lead produced in the Central district in 1945 came as byproducts of mining and milling fluorspar ore. H. M. Williamson & Son operated the Argo, Brown Spar, and Emmett group of mines and treated 21,036 dry tons of fluorspar ore. Some gold was recovered by amalgamation and cyanidation from the John Jay and Invincible mines.

Gold Hill district.—The Ingram mine was operated from August through December and produced 563 tons of gold ore, which were shipped to the Golden Cycle mill. Aaron Stromberg shipped 324 tons of zinc-lead ore from the Gardner mine to the Golden Cycle custom mill for selective-flotation treatment. The property was operated from January through May. The partnership, Griswold & Stromberg, operated the Home Sweet Home mine from January through May and shipped 237 tons of gold ore to the Golden Cycle mill. Zinc-lead ore was produced from the Slide mines and siliceous ore from the Comet No. 2 and Tramway mines in 1945.

Grand Island district.—A small lot of silver ore was shipped from the Blue Bird mine to the Leadville smelter in 1945.

Sugar Loaf district.—Production from the Sugar Loaf district was principally gold ore shipped to the Golden Cycle mill for treatment; however, one lot of zinc-lead ore was shipped from the J. Albion claim. Mines active in the Sugar Loaf district in 1945 included the Poorman-Relief, Wood Mountain group, and Alpine Horn, all of which shipped gold ore to the Golden Cycle mill for treatment.

Ward district.—Charles W. Strong, Jr., worked the Boston Lode from October through December and shipped 26 tons of gold ore to the Leadville smelter.

CHAFFEE COUNTY

Granite district.—A small lot of gold ore from the Monogram mine was amalgamated and the bullion sent to the Denver Mint in 1945.

Monarch district.—The entire output of the Monarch district in 1945 came from the Alaska and Little Annie claims of the Garfield mine group, operated by S. E. Burleson. The property was active from April 28 through the remainder of the year. Production amounted to 1,454 tons of zinc ore, part of which was shipped to the Golden Cycle custom mill at Colorado Springs and the remainder to the Leadville milling unit of the American Smelting & Refining Co. at Leadville. The ore contained 48 ounces of gold, 5,004 ounces of silver, 14,794 pounds of copper, 39,584 pounds of lead, and 516,064 pounds of zinc. Some development was done in the mine, and it was reported that during December a body of copper-silver ore was opened up 58 feet below the tunnel level. The mine is developed by an 1,800-foot tunnel from which three winzes (30 feet, 40 feet, and 60 feet) and two drifts (30 feet and 85 feet) have been opened.

CLEAR CREEK COUNTY

Alice district.—Some clean-up from the Gold Bug mine was shipped to a smelter in 1945.

Argentine district.—O. Barlow Willmarth operated throughout most of 1945 the National, Sussex, and Newcastle claims in Grizzly Gulch 8 miles southwest of Georgetown. A total of 2,712 wet tons of zinc-lead ore from the property was treated in the Silver Spruce mill, which made 280 tons of zinc-lead middlings containing 168 ounces of gold, 2,297 ounces of silver, 3,785 pounds of copper, 246,830 pounds of lead, and 79,641 pounds of zinc. The middlings were shipped to the Midvale, Utah, concentrator for further treatment. On January 31, 1946, the three patented claims operated in 1945 and five claims held by location were sold to the Lupton Mining Co.

Cascade and Ute Creek district (Idaho Springs).—The Tyone Mining Co. shipped a small lot of silver ore from the Tyone (formerly Charter Oak) mine to the Leadville smelter in 1945.

Empire district.—Zinc-lead ore from the Ivanhoe dump and lead ore from the Atlantic mine (shipped to smelters) and gold ore from the Mint mine (shipped to the Golden Cycle custom mill) comprised the production from the Empire district in 1945.

Griffith district.—By far the largest producer of zinc and lead in the Griffith district and in Clear Creek County in 1945 was the Mendota mine at Silver Plume, operated continuously in 1945 by Wallace K. Howard in the name of the Utze Lode Mining Co. The ore was treated in the 100-ton Mendota mill, equipped for gravity and flotation concentration. Approximately 4,400 tons of ore were treated and made 512 tons of high-grade lead concentrates and 1,079 tons of zinc concentrates. The lead concentrates were shipped to the Leadville smelter and the zinc concentrates to the Midvale, Utah, smelter, which in turn shipped them to the Anaconda, Mont., electrolytic zinc smelter. The character of the ore is such that most of the lead can be concentrated into a high-grade product by jigging. To this product is added the lead flotation concentrate. Most of the development in 1945 consisted of drifting on the ore body. The Mile High Mining Co. operated the Smuggler mine and the Silver Leaf mill most of the year. Zinc and lead concentrates were produced and shipped to the Amarillo, Tex., and Leadville smelters. Zinc-lead ore was shipped to the Golden Cycle mill from the New Boston mine. A small tonnage of ore was produced from the Pelican, Payrock, and Stevens mines.

Idaho Springs district.—Virtually all the ore produced from the mines active in the Idaho Springs district in 1945 was concentrated at various custom mills in the State. A total of 2,655 tons of ore from the East Lake, Franklin, Bald Eagle, and Stanley mines was treated at the Golden Cycle mill at Colorado Springs. Local custom mills operating intermittently during the year included the Silver Spruce, Ruth, Chicago Creek, and Barrett. These mills treated 1,157 tons of ore from the Idaho Bride, Franklin, and Dixie mines. The concentrates produced were shipped to the Leadville and Tooele, Utah, smelters. A little placer gold was recovered from sluicing on Clear Creek.

Montana district.—The Jo Reynolds mine and dump operated under lease accounted for the entire production from the Montana district in 1945. S. S. Huntington milled approximately 3,700 tons of dump ore and made 108 tons of concentrates rich in silver, which were shipped to the Leadville smelter. Robineaux & Sperlach, lessees at the mine, shipped 380 tons of zinc-lead ore to the Golden Cycle mill and 53 tons of similar ore to the Leadville milling unit of the American Smelting & Refining Co.

Trail Creek district.—Zinc-lead ore from the Ben Harrison mine, operated by the Harrison-Croesus Mining Co., comprised the bulk of the output from the Trail Creek district in 1945. A total of 588 tons was shipped to concentrating mills—451 tons to the Golden Cycle mill at Colorado Springs and 137 tons to the Resurrection mill at Leadville. T. J. Traynor operated the Lone Tree mine and shipped a car of ore to the Golden Cycle mill for treatment.

COSTILLA COUNTY

Gold was recovered from a placer operation in Costilla County in 1945.

CUSTER COUNTY

Hardscrabble district.—The Lady Franklin mine near Westcliffe, the largest zinc producer in Custer County in 1945, was operated by George L. Beardsley the entire year. A total of 1,646 tons of zinc-lead ore was mined, of which 1,461 tons were shipped to the Golden Cycle mill for concentration and 185 tons to the Leadville milling unit of the American Smelting & Refining Co. Colgate & Hoge operated the Keystone mine throughout the year under lease agreement. A total of 1,732 tons of zinc-lead ore was produced, of which 1,584 tons were shipped to the Golden Cycle mill and 148 tons to the Leadville milling unit of the American Smelting & Refining Co. William A. Walker and partners worked the Defender mine throughout 1945 and shipped 795 tons of crude silver-lead ore to the Leadville smelter. The ore contained a total of 5 ounces of gold, 6,121 ounces of silver, 187 pounds of copper, and 208,353 pounds of lead. The New Hope Mining Co. from January to the end of September rehabilitated the New Hope property, retimbering the shaft and underground workings preparatory to further operations. On the surface, the roads leading to the property were repaired, and a commissary building and hoist house were built. During the period of rehabilitation, 329 tons of zinc-lead ore were mined, of which 227 tons were shipped to the Golden Cycle mill and 102 tons to the Tooele, Utah, concentrator for treatment. All operations were conducted by the New Hope Mining Co. under bond and lease until September, when the property was repossessed by Major Priorities, Inc., the owner. Crude zinc-lead ore from the Bull Domingo mine was shipped to the Golden Cycle mill, and a small lot of lead ore was shipped from the Passiflora mine to the Leadville smelter.

DOLORES COUNTY

Pioneer district (Rico).—The Rico Argentine Mining Co., one of the large producers of lead and zinc in Colorado, operated its extensive property near Rico continuously in 1945 and shipped lead and zinc concentrates to the Leadville and the Amarillo, Tex., smelters. Ore milled in the company 135-ton selective-flotation plant totaled 35,796 tons, averaging about 17 percent zinc and 9 percent lead. The lead concentrates produced (3,600 tons) contained 107 ounces of gold, 123,122 ounces of silver, 49,858 pounds of copper, 4,728,098 pounds of lead, and 461,165 pounds of zinc, and the zinc concentrates (8,127 tons) contained 64 ounces of gold, 41,324 ounces of silver, 163,552 pounds of copper, 370,707 pounds of lead, and 8,753,806 pounds of zinc. Development during the year comprised 157 feet of winzes and shafts, 5,637 feet of drifts and crosscuts, 788 feet of raises and inclines, and 3,128 feet of diamond drilling. Markey Bros. operated the Yellow Jacket group under lease from the Rico Argentine Mining Co. and shipped 266 tons of zinc-lead ore to the Midvale, Utah, concentrator; 153 tons were shipped also by A. C. Sampfel and H. Barnes from the North Lilly mine.

EAGLE COUNTY

Red Cliff district (Battle Mountain).—The Red Cliff district continued to rank first among Colorado districts in the total value of its production of the five metals. In 1945 the district produced 44 percent of the total output of recovered zinc in the State. The New Jersey Zinc Co. Empire zinc division operated its Eagle mine and 600-ton underground selective-flotation mill continuously during the year, maintaining an almost constant rate of production during all the year except for the period November and December, when output was lowered due to a fire underground. The previous high rate of production was resumed in January 1946. The ore mined and milled yields zinc concentrates chiefly, which are shipped to the company smelters at Depue, Ill., and Palmerton, Pa. Some lead concentrates were made and shipped to the Leadville smelter. Some copper-iron-silver-gold ore was shipped to the Leadville and Murray, Utah, smelters.

EL PASO COUNTY

GOLDEN CYCLE MILL

The Golden Cycle mill at Colorado Springs operated throughout the year on company and custom ores from nearly all mining districts in the State; 227,063 tons of ore of all classes were treated in 1945 compared with 221,543 tons in 1944. Of the total ore treated, 129,770 tons (113,565 tons in 1944) were company and custom gold-silver sulfotelluride ores from the Cripple Creek district (Teller County), and 97,293 tons (107,978 tons in 1944) were miscellaneous zinc-lead, zinc-lead-copper, and gold ores and middlings from Boulder, Chaffee, Clear Creek, Custer, Fremont, Gilpin, Gunnison, Lake, Park, Pitkin, Saguache, San Juan, San Miguel, and Summit Counties. The tonnage from the Cripple Creek district in 1945 was well over 50 percent dump ore; as a result, the average gold content of the ore was considerably below normal. The 500-ton selective-flotation unit of the mill handled approximately 96,112 tons of mostly complex zinc-lead sulfide ores in 1945. Because of the varied character of the ores purchased, the metallurgy is not always the same. Ores from the Cripple Creek district are roasted, amalgamated, and cyanided.

Complex ores containing base metals are first treated by selective flotation; the tailings from this operation are separated into sands and slimes and cyanided.

Owing to strikes at eastern zinc smelters during the latter part of 1945, the Golden Cycle Corp. notified all its shippers of complex ores that after December 1, 1945, no further shipments would be accepted. Ores in transit on December 1, however, would be accepted.

FREMONT COUNTY

Arkansas River district.—Thomas G. Stevens shipped ores of several classes from an old dump at the Florence smelter site to the Leadville and Coffeeville, Kans., smelters.

Cotopaxi district.—The Monarch Galena Co. operated its Cotopaxi mine throughout 1945 and shipped 3,862 tons of zinc ore to the Golden Cycle mill and the Leadville milling unit for treatment. The ore contained 97 ounces of gold, 8,372 ounces of silver, 115,118 pounds of copper, 109,354 pounds of lead, and 1,047,077 pounds of zinc. The company reported that the ore body mined from 1942 through 1945 was nearly exhausted, and mostly low-grade ore remains. The company also reported that development completed in 1945 comprised 100 feet of drifts.

Grape Creek district.—Christison & Van Buskirk operated the Horseshoe (School Section) mine throughout most of 1945 and shipped zinc-lead ore to the Golden Cycle mill for treatment. On November 11, 1945, the mine was acquired by Eichheim & Hart, which operated the property the remainder of the year and shipped 3 cars of zinc-lead ore to the Golden Cycle mill and the Leadville milling unit for treatment.

GILPIN COUNTY

Southern districts (Blackhawk, Central City, Nevadaville, Russell Gulch).—The Meeker-Success group operated by Eugene T. Richards and the Boodle mine operated by L. H. Griffith contributed the bulk of the output from mines in the Southern districts of Gilpin County in 1945. Crude siliceous ore (81 tons) was shipped from the Meeker-Success group to the Leadville and Midvale, Utah, smelters; in addition, approximately 300 tons of zinc-lead ore were milled, making zinc-lead concentrates, which were shipped to the Tooele, Utah, smelter. A little over 300 tons of zinc-lead ore from the Boodle mine were milled during 1945, making concentrates which were shipped to the Leadville and Tooele, Utah, smelters. Neeper & Co. operated the West Notaway mine intermittently during 1945 and shipped a total of 65 tons of copper ore to the Golden Cycle mill. Among other mines active in the district in 1945 were the Martin, Justice Hill Extension, Banta Hill, and Denver. Several small-scale placer operations on the North Fork of Clear Creek and in Russell Gulch were active during 1945. All the placer gold recovered was from hand sluicing.

Northern district.—A little gold was recovered from the Perigo mine dump in 1945.

GUNNISON COUNTY

Elk Mountain district.—A. D. Hahn shipped a test lot of ore from the Forest Queen group to the Leadville smelter in 1945.

Rock Creek district.—A. J. Betz worked the Catalpa mine in 1945 and shipped 89 tons of ore containing 306 ounces of silver, 3,021 pounds of copper, 9,419 pounds of lead, and 14,573 pounds of zinc to the Leadville milling unit of the American Smelting & Refining Co.

Taylor Park district.—A total of 225 tons of carbonate silver-lead ore was shipped crude to the Midvale, Utah, and Leadville smelters from the Bull Domingo mine on Italian Mountain by John Lambertson, part owner, and Jack McLain, under lease agreement; the operations were conducted separately. The Star mine, adjoining the Bull Domingo and connected to it by a drift, was operated nearly all year by John Lambertson; 42 tons of carbonate silver-lead ore were shipped to the Midvale, Utah, smelter.

Tomichi district.—The Callahan Zinc-Lead Co. continued to operate its Akron unit at White Pine during 1945. The unit comprises a large number of claims, of which only the Lost Contact and Sunset lodes were productive during the year. The property has no milling facilities; consequently the ore mined was shipped to the Midvale, Utah, concentrator, the Golden Cycle mill, and the Leadville milling unit of the American Smelting & Refining Co. for treatment. A total of 6,176 tons was treated which contained approximately 68 ounces of gold, 27,800 ounces of silver, 38,000 pounds of copper, 959,000 pounds of lead, and 1,300,000 pounds of zinc. The property is developed by a 3,000-foot adit (with 250 feet of raises and 1,000 feet of drifts) and an 800-foot adit (with 750 feet of drifts); 850 feet of new drifts were completed in 1945.

HINSDALE COUNTY

Lake district.—John M. Wells, lessee, shipped a test lot of copper ore from the Gold Quartz Lode to the Garfield, Utah, smelter in 1945.

JEFFERSON COUNTY

Placer gold was recovered from several small sluicing operations on Clear Creek in 1945.

LAKE COUNTY

California (Leadville) district.—One furnace of the American Smelting & Refining Co. Arkansas Valley lead bullion-leady copper matte smelter was operated during 1945. A total of 88,152 tons of material was received for treatment, of which 70,444 tons were considered of domestic origin and 17,708 tons of foreign origin. Over half of the material of domestic origin came from mines in almost every active mining district of Colorado; the remainder was largely residues from smelters or reduction plants in Illinois, Massachusetts, Maryland, New Jersey, Oklahoma, and Pennsylvania. Much of the material of foreign origin was transferred by the Metals Reserve Company from stocks held at eastern plants to Leadville in order to release lead.

In March 1945 the American Smelting & Refining Co. purchased the gravity- and flotation-concentration and amalgamation mills of the California Gulch Mining & Milling Co.—one 75- to 125-ton capacity and one 450-ton capacity. The larger mill was remodeled to handle the company ore from the Lucky Strike mine near Kokomo, Summit County, and custom ore from various shippers. The mill is known as the Leadville milling unit of the American Smelting & Refining Co. Operations at the mill commenced July 3 and continued the rest of 1945. Custom ore was received from operators in Clear Creek, Custer, Gunnison, Lake, Park, Pitkin, Saguache, San Juan, and Summit Counties.

The Resurrection Mining Co. operated its Resurrection mine the entire year and was the largest producer of lead and zinc in the county. The mine is developed by a vertical shaft 1,323 feet deep, with six different levels, and by a 4-mile tunnel at the surface which intersects the shaft at the 850-foot level. A total of 1,253 feet of development was completed in 1945, including 936 feet of drifts and 317 feet of raises. The property is equipped with a 600-ton selective-flotation mill which has two 300-ton units; only one unit was operated in 1945. The installation of a new flotation circuit was completed in 1945. Aside from the treatment of company zinc-lead sulfide ore, substantial quantities of custom ore from mines in Clear Creek, Lake, Park, and Summit Counties were handled. Virtually the entire mill feed in 1945 was complex zinc-lead ore and was concentrated into lead and zinc concentrates which were shipped to the Leadville and Amarillo, Tex., smelters.

The Ore & Chemical Co. 1,000-ton Heavy Media separation plant was operated until December 1, 1945, on ores from the R. A. M., North Moyer, Robert E. Emmett, Colorado No. 2, M. A. B., and Tucson dumps. The plant was idle throughout December due to strikes at zinc smelters which made it impossible to market the zinc-lead middlings produced. The Heavy Media plant is rated at 1,000 tons daily capacity, but the actual tonnage that can be handled depends largely on the character of the dump ore treated; it is smallest when material is wet, contains clay, and is fine. In 1945 the tonnage treated ranged from a low average of less than 600 tons to a high of well over 1,200 tons daily. During the 11 months of operation, approximately 251,000 tons of dump material were treated and made 52,882 tons of zinc-lead middlings which were shipped to the Golden Cycle mill for further concentration. The middlings were made up of both sink concentrates (obtained from the Heavy Media separation) and jig concentrates. The sink concentrates contain about 11.6 percent zinc and 4 percent lead, while the jig concentrates contain about 6.4 percent zinc and 3 percent lead.

John Hamm Mining & Milling, Ltd., operated its 600-ton gravity-concentration mill the entire year on ore from the Maid of Erin and Wolftone dumps. A total of 91,109 tons of dump material was reported as treated, making 28,277 tons of zinc-lead-silver jig concentrates which contained 724 ounces of gold, 131,851 ounces of silver, 287,198 pounds of copper, 1,789,437 pounds of lead, and 3,305,075 pounds of zinc. The concentrates were shipped to the Golden Cycle mill and Leadville milling unit for further concentration.

Ore was milled at either the Resurrection mill or Leadville milling unit from the Garibaldi dump and the New Monarch, Little Johnny, Ibex, Fortune, A. Y. & Minnie, Resurrection No. 1, Valley, Thomas Starr Placer, and Dolly B mines in 1945. Crude smelting ore was shipped to the smelter at Leadville from the New Monarch, Ibex, Commerce, Golden Eagle, Hummer No. 1, Rock, Matchless, Little Ellen, and Dolly B mines; several thousand tons of old slag from the American Smelting & Refining Co. dump were re-treated in 1945.

Tunneling operations on the new Leadville drainage tunnel were discontinued September 1, 1945, after the tunnel had been driven 6,600 feet. Late in 1945 it was reported that Steirs Bros. Construction Co., the contractor driving the tunnel, had removed all its equipment. The Bureau of Mines keeps a maintenance crew at the tunnel.

St. Kevin district.—Some clean-up was shipped to the Leadville smelter from the St. Kevin property in 1945.

LA PLATA COUNTY

California (or La Plata) district (Herperus, La Plata).—High-grade gold ore shipped to the Midvale, Utah, and Garfield, Utah, smelters from the Bessie G and Idaho mines was the only output from La Plata County in 1945.

MINERAL COUNTY

Creede district.—The Emperius Mining Co., which in 1945 controlled nearly all mining properties in the Creede district, operated its 100-ton flotation mill the entire year on ore from the Amethyst group of properties, New York group, Commodore group, Del Monte-Aspen group, and Equinox mine. The flotation mill was operated under lease until March 1945, when it was purchased from Creede Mills, Inc. No custom ores were purchased during the year; all ores milled were obtained from the properties on company account, with the exception of a small quantity mined by lessees. The mill was operated on a three-shift basis 7 days a week and treated 18,006 tons of ore, which contained 117 ounces of gold, 449,525 ounces of silver, 904,101 pounds of lead, and minor amounts of copper and zinc. The concentrates made (1,726 tons) were predominantly silver-lead and were shipped to the Leadville smelter; 43 tons of zinc-lead concentrates were shipped to the Tooele, Utah, smelter. The Ridge Mining Co. shipped 348 tons of lead ore to the Leadville smelter from the Ridge property.

MONTROSE COUNTY

La Sal district.—The New Cashin Mines, Inc., continued to ship copper fluxing ore to the Garfield, Utah, smelter from the Cashin group of claims.

San Miguel River district.—Some placer gold was recovered from gravels in the San Miguel River in 1945.

OURAY COUNTY

Red Mountain district.—Nearly all the production from the Red Mountain district in 1945 was shipped to the Midvale, Utah, concentrator. Six properties were productive during the year; the largest was the Genesee-Vanderbilt and Yankee Girl group of claims, which was operated by George E. Collins under lease. The property was worked throughout the year and produced 1,218 tons of zinc-lead-copper-silver ore, which contained 43 ounces of gold, 5,894 ounces of silver, 32,689 pounds of copper, 197,596 pounds of lead, and 189,721 pounds of zinc. The other mines active in the district in 1945 were the San Antonio group of mines, Lost Day, Galena, Belfast, and Ida L.

Sneffels district.—By far the largest producer in Ouray County in 1945 was the Camp Bird mine and its 100- to 125-ton amalgamation-flotation mill, operated the entire year by the King Lease, Inc. A total of 25,947 tons of gold-silver ore was treated, making 2,249 tons of zinc-lead-copper-silver-gold concentrates that were shipped to the Tooele, Utah, lead smelter for treatment. The bullion recovered by amalgamation was shipped to the Denver Mint. Development during the year included 812 feet of raises, 289 feet of drifts, and 2,104 feet of diamond drilling.

Uncompahgre district.—The Franz brothers, operating as the General Ore Reduction Co., continued to run a custom mill in Ouray in 1945. The mill made lead and zinc concentrates, all of which were shipped to the Midvale, Utah, smelter for smelting or transfer to the Anaconda, Mont., electrolytic zinc plant. J. R. Sonza, lessee of the Bachelor Consolidated mine, shipped approximately 4,200 tons of zinc-lead-silver ore to the General Ore Reduction Co. mill for concentration. The mine was rehabilitated through the use of a Reconstruction Finance Corporation loan, which has now been paid by earnings from the mine. The Southwest Metal Co. operated the Micky Breen mine and James H. Wardle the Terrible Queen; both shipped ore to the General Ore Reduction Co. mill for concentration.

PARK COUNTY

Alma Placers district.—Some gold was recovered by sluicing in 1945.

Beaver Creek district.—Sluicing on Beaver Creek yielded some placer gold in 1945.

Buckskin district.—The Buckskin Joe Mines, Ltd., operated its Phillips group of mines in Buckskin Gulch and the Alma-Betts 65-ton selective-flotation mill in Mosquito Gulch throughout 1945. The products of the mill were lead, zinc, and iron concentrates; a small lot of high-grade gold-silver-lead ore was shipped crude to the Leadville smelter. The company also operated the Baxter mine under lease and milled the ore making lead concentrates. A clean-up at the Criterion millsite and a test shipment from the Sweet Home mine constituted the only other production in the district in 1945.

Fairplay district.—The total value of metal production from Park County in 1945 increased 70 percent over 1944 and that of the Fairplay district from $70 in 1944 to $257,743 in 1945. The chief cause of both gains was the resumption of gold dredging by the South Platte Dredging Co. on July 12 after 3 years of idleness. Dredging was continued the remainder of the year. The property controlled by the company aggregates approximately 2,800 acres of ground along the South Platte River near Fairplay. The dredge is electrically powered and used 103 12-cubic foot buckets. In 1945, 2,204,795 cubic yards of gravel were washed, yielding about 7,300 fine ounces of gold and 1,280 ounces of silver. In 1945 the Lee Andrews, Gold Pan, and Cincinnati placers were worked. Lessees recovered some gold from the Snowstorm placer by sluicing.

Freshwater district.—Copper ore from the Betty and Futurity-Utopia mines shipped to the Garfield, Utah, smelter and zinc ore milled from the Betty accounted for the output from the Freshwater district in 1945.

Mosquito district.—The Alma Mills, Inc., treated a stock pile of ore from the North London dump in 1945 which had been hauled to the mill in 1944. The stock pile of 1,336 tons of gold ore required 24 days to concentrate, making 39 tons of gold concentrates which were shipped to the Leadville smelter. Some clean-up from the South London mill site was shipped to a smelter.

Pulver district.—The Great Western mine on Wilkerson Pass 10 miles west of Lake George was worked from January 1 to October 1945 by O. N. Sandholm; 1,090 tons of zinc-copper ore containing 8 ounces of gold, 15,137 pounds of copper, and 89,840 pounds of zinc and small amounts of silver and lead were shipped to the Golden Cycle mill for concentration.

PITKIN COUNTY

Roaring Fork district (Aspen).—The Midnight Mining Co. operated its Midnight mine and 50-ton selective-flotation mill the entire year. A total of 5,752 tons of ore containing 15.9 ounces of silver to the ton, 2.8 percent lead, and 2.2 percent zinc was concentrated by selective flotation into 225 tons of lead concentrates high in silver and 98 tons of zinc concentrates. Herron Bros. operated its 150-ton gravity-concentration mill throughout 1945 and treated approximately 12,000 tons of dump material from the Smuggler-Durant, Henry Clay, and Molly Gibson mines. The dump material was concentrated into 455 tons of zinc-lead-silver middlings, part of which was shipped to the Golden Cycle mill and the remainder to the Leadville milling unit for further treatment. In addition, 647 tons of silver-lead ore were shipped crude to the Leadville smelter. Jessen Bros. shipped 109 tons of zinc-lead ore from the Aspen Contact to the Tooele, Utah, smelter. Maintenance work at the Mountain Ranger mine resulted in production of 10 tons of lead ore, which were shipped to the Leadville smelter.

RIO GRANDE COUNTY

Summitville district.—The Gold Links mine comprises a large number of claims in the Summitville district near Wightman's Fork of the Alamosa River. The property, equipped with a 50-ton amalgamation and flotation concentration mill, was operated (under special grant from the WPB until July 1, 1945) throughout 1945 by the Gold Links mine, a lessee. A total of 948 tons of ore, averaging 0.47 ounce of gold to the ton, about 9 ounces of silver, and minor quantities of copper, was milled; 96 tons of gold concentrates were made and shipped to a smelter, and gold bullion was shipped to the Denver Mint.

ROUTT COUNTY

Milbank Franz worked the Greenville mine in the Hahns Peak area during 1945 and shipped 494 tons of zinc-lead ore to the Midvale, Utah, custom concentrator. The ore contained a total of 4 ounces of gold, 766 ounces of silver, 5,744 pounds of copper, 15,625 pounds of lead, and 139,073 pounds of zinc.

SAGUACHE COUNTY

Kerber Creek district (*Bonanza*).—The Superior-Erie group of mines was the most productive in Saguache County in 1945. During the first 3 months of the year Lester Pickering operated the group; thereafter, operations were by the Superior Mines Division of the Conejos Corp. A total of 4,754 tons of ore was shipped, containing 59 ounces of gold, 36,061 ounces of silver, 51,482 pounds of copper, 396,237 pounds of lead, and 811,156 pounds of zinc; 2,956 tons of the total ore were shipped to the Midvale, Utah, custom concentrator and the remainder to the Leadville milling unit of the American Smelting & Refining Co. The Pratt-Bonanza Mining & Milling Co. worked the St. Louis group of mines the entire year, completing 315 feet of tunnel development and 200 feet of drift development. The production—948 tons of ore containing 10 ounces of gold, 3,559 ounces of silver, 4,505 pounds of copper, 112,162 pounds of lead, and 168,906 pounds of zinc—was shipped to the Bauer, Utah, custom concentrator for treatment. Output from the Rawley mine amounted to 517 tons of copper ore shipped to the Garfield, Utah, smelter, 190 tons of lead ore to the Leadville smelter, and 48 tons of zinc-lead ore to the Midvale, Utah, custom concentrator. Other production shipped either to the Midvale, Utah, custom concentrator or the Golden Cycle mill came from the Warwick group of mines, Cora, and Little Johnny.

SAN JUAN COUNTY

Animas district.—The Shenandoah-Dives Mining Co. continued in 1945 to be the chief producer of metals in San Juan County. The company worked the Shenandoah-Dives consolidated group of claims on King Solomon Mountain and the Silver Lake group of properties, owned by the American Smelting & Refining Co. The Silver Lake property is connected underground by a crosscut from the Shenandoah workings. In 1945, 152,084 tons of ore from the Shenandoah-Dives and Silver Lake properties were milled in the 700-ton Shenandoah-Dives selective-flotation mill. The mill is on the Animas River near Silverton and is connected with the Shenandoah-Dives mine by an aerial tramway. A total of 4,205 tons of concentrates was made, including 2,493 tons of flotation lead concentrates, 1,012 tons of flotation zinc concentrates, and 700 tons of iron-gold-silver-lead table concentrates, containing in aggregate 17,238 ounces of gold, 142,968 ounces of silver, 404,047 pounds of copper, 2,258,893 pounds of lead, and 1,602,004 pounds of zinc. The lead and iron concentrates were shipped to the Leadville smelter, and the zinc concentrates were shipped to the Amarillo, Tex., smelter. Development completed was 1,935 feet of drifts, 64 feet of raises, and 757 feet of diamond drilling. A small quantity of custom ore was treated in the mill from the Bandora, Kittimac, Mountain Queen, and Lead Carbonate mines, all in San Juan County.

The Denver Equipment Co., as agent, operated the Pride of the West group and Green Mountain mines and the Pride of the West concentrator at Howardsville during 1945 for the owners of the property, Pride of the West, Inc. The Pride of the West group was worked throughout the year, while the Green Mountain mines were active only part of the year, due to winter conditions. The concentrator at Howardsville is a 100-ton selective-flotation mill and in 1945 handled 27,473 tons of ore and made 2,159 tons of combined flotation and jig lead concentrates and 401 tons of zinc concentrates. Due to the low zinc content of the ore from the Pride of the West group of mines, no zinc concentrates were made when the mill feed came only from this group. Reserves of broken ore were increased during 1945 to a point that virtually assures capacity operation of the mill. Some additional grinding equipment was installed in the mill during the year; development completed in the mines amounted to 1,616 feet of drifts and 1,674 feet of diamond drilling.

Highland Mary Mines, Inc., operated its Highland Mary mine and 100-ton selective-flotation mill in Cunningham Gulch from May 7 until December 28, 1945. Due to snowslides in Cunningham Gulch the operation is seasonable, closing down for about 4 or 5 months during the winter. Attempts are being made to shorten the shut-down period or to eliminate it. The vein being mined is the southerly extension of the Shenandoah-Dives vein worked by the Shenandoah-Dives Mining Co. The main working level is entered by way of the Bradley crosscut at an elevation of 11,350 feet; ore is trammed about 3,000 feet to the portal by mule power. Ore is crushed to 1 inch at the mine portal and delivered to an aerial tram 1,200 feet long, which carries it to the concentrating mill approximately 650 feet below the mine portal. The tonnage of ore treated during 1945 was more than double that in 1944 due to the increased capacity of the mill. The mill makes a bulk flotation concentrate with a jig for recovering free gold. The bulk concentrate and jig concentrate were shipped separately to the Leadville smelter. During the period of operation, 13,028 tons of ore containing approximately 2,866 ounces of gold, 64,749 ounces of silver, 41,689 pounds of copper, 604,499 pounds of lead, and 44,295 pounds of zinc were concentrated into 964 tons of gold-silver-copper-lead concentrates. Mine development completed in 1945 amounted to 375 feet of drifts.

Zinc-lead ore from the Lark mine was shipped to the Golden Cycle mill for treatment, and the Kittimac mine produced 211 tons of ore which were milled at cutsom plants. A car of lead ore was shipped from the Belcher mine to the Leadville smelter.

Eureka district.—The Foursome Mining Co. operated the Columbus mine from June 22 to the end of the year and shipped 184 tons of ore to the Golden Cycle mill and 417 tons of ore to the Leadville milling unit for treatment. Ore for milling was shipped either to the Shenandoah-Dives mill or Tooele, Utah, custom concentrator from the Burrows, Lead Carbonate, and Mountain Queen mines. Ore was shipped also from the Mountain Queen to the Leadville smelter.

Ice Lake Basin district.—Esmeralda Lease operated the Bandora mine from May 10 to September 7; 182 tons of zinc-lead ore were shipped to the Shenandoah-Dives mill.

SAN MIGUEL COUNTY

Iron Springs district.—Dan Roth amalgamated a small quantity of gold ore from the Commercial mine in 1945.

Upper San Miguel district (Telluride).—Telluride Mines, Inc., operated throughout 1945 but on a much smaller scale than in 1944, due to lack of manpower. The company 550-ton amalgamation and gravity- and flotation-concentration mill at Pandora 2½ miles east of Telluride treated company ore from the Smuggler Union, Montana, and Cimarron mines. Mill tonnage was augmented by ore from the Tom Boy and Argentine dumps. The lead and zinc concentrates made were shipped to the Midvale, Utah, smelter and to the Anaconda, Mont., electrolytic zinc plant, respectively. Gold bullion was recovered by amalgamating gold concentrates caught in a jig placed in the mill circuit at the discharge of the ball mill; the bullion was sent to the Denver Mint. Development of the property continued during the year, and toward the end of 1945 surface work was begun for a low-level adit.

The production of the Idarado Mining Co. is credited to San Miguel County, although the property is developed and worked through the 12,000-foot Treasury tunnel, with its portal in Ouray County; the ore comes from claims in San Miguel County. During 1945 the Idarado continued to develop its Black Bear property through the Treasury tunnel, although operations were handicapped by a shortage of labor and absenteeism. The 300-ton selective-flotation mill built during 1944 at the portal of the Treasury tunnel was operated the entire year. A total of 46,662 tons of gold-silver-copper-lead-zinc ore was milled, and the lead-copper concentrates recovered were shipped to the Leadville smelter, the copper concentrates to the Garfield, Utah, smelter, and the zinc concentrates to the Amarillo, Tex., smelter. The addition of more mill capacity during 1946 was planned. The Black Bear vein was developed for a considerable distance along the strike of the vein for stoping on the Treasury tunnel level. Some progress was made on the raise from the Treasury tunnel level to the old Black Bear workings 1,100 feet above. At the end of the year the raise had advanced over 400 feet. Intermediate levels were cut at 200 and 375 feet and are being developed each way along the vein. Development in 1945 included 1,350 feet of drifts completed, 594 feet of raises, and 534 feet of diamond drilling.

The Alta Mines, Inc., continued full-year operation of its 100-ton flotation mill and Alta-St. Louis mine. Production was smaller than in 1944 due to acute shortage of labor; however, 32,914 tons of gold ore were mined and milled, which made 1,530 tons of lead-copper concentrates. Some gold ore was amalgamated in 1945 from the Allegheny and Orion lodes.

SUMMIT COUNTY

Breckenridge district.—The bulk of the output from the Breckenridge district in 1945 was zinc and zinc-lead ore shipped to custom milling plants. The Sally Barber mine was operated by F. P. Lilly and T. C. Moran under lease agreement; 1,377 tons of zinc ore containing over 30 percent zinc were shipped to Midvale and Tooele, Utah, concentrators. The Golden Cycle Corp. operated its Monte

Cristo mine from June 26 to November 27, 1945, and mined 3,843 tons of zinc-lead ore. The ore contained 202 ounces of gold, 20,464 pounds of copper, 403,745 pounds of lead, and 296,664 pounds of zinc and was shipped to the company selective-flotation concentrator at Colorado Springs. The Garvie London Gold Mining Co. operated its Country Boy mine throughout 1945 and shipped 1,657 tons of ore to the Resurrection Mining Co. mill at Leadville; the ore contained 82 ounces of gold, 4,086 ounces of silver, 1,345 pounds of copper, 23,074 pounds of lead, and 642,501 pounds of zinc. Some gold ore was shipped from the Jumbo mine.

Green Mountain district.—Walter McDaniel shipped zinc ore from the Big Four mine to the Combined Metals Reduction Co. custom mill at Bauer, Utah, during 1945.

Montezuma district.—The Florado Mining Co. operated the Pinnacle claim throughout the year, but its 100-ton flotation mill was operated intermittently. Approximately 1,500 tons of lead ore were handled, making 154 tons of lead concentrates shipped to the Leadville smelter. About 240 tons of lead ore from the Silver King mine were treated by the Summit Mining & Milling Co. in its 25-ton flotation mill; only part of the concentrates made was marketed—the remainder was stored. Jeffrey & Ulibarri operated the Erickson mine and shipped 211 tons of zinc-lead ore to the Leadville milling unit and 60 tons of lead ore to the Leadville smelter. Other mines in the Montezuma district in 1945, from which ore was trucked to either the Leadville milling unit or to the Resurrection mill at Leadville, included the New York, Ida Belle, Rose, Morgan Group, and Superior.

Ten Mile (Kokomo, Robinson) district.—The Ten Mile district assumed added importance as a zinc and lead producer in 1945. The output of lead nearly trebled and zinc nearly doubled, as compared with 1944. The American Smelting & Refining Co. operated its Lucky Strike group of properties (Washington & Hancock group of mines) the entire year. The operation in the Ten Mile district is known as the Kokomo unit. The mine ore was shipped to the Resurrection mill at Leadville during the first 5 months of the year; after that it was shipped to the company Leadville milling unit. The tonnage shipped for treatment was virtually all zinc-lead mill ore; however, about one-half a car of lead ore was shipped direct to the Leadville smelter. The property is developed by the Victory tunnel, which is approximately 1,000 feet long; 700 feet of drifts were completed as development in 1945. Both the Resurrection mill and the Leadville milling unit received zinc-lead ore from the Wilfley mine, which was worked throughout 1945 by the Wilfley Leasing Co. A total of 7,401 tons of ore (including about 1,200 tons of dump ore) was shipped and contained 444 ounces of gold, 30,095 ounces of silver, 322,564 pounds of lead, 1,377,753 pounds of zinc, and some copper. Considerable development—mainly diamond drilling with the purpose of locating deeper ore—was completed during the year. The Kokomo Metals Consolidated Co. operated the Nettie B mine and shipped zinc-lead ore to the Resurrection mill until June, after which no shipments were made during the balance of the year; on August 1, R. E. Mackey began a development program which continued the remainder of 1945. Zinc-lead-silver ore was shipped from the Wilson and Kimberly mines to custom concentrators at Leadville and Colorado Springs. Some silver ore and lead ore were shipped to the Leadville smelter from the Golden Queen mine.

TELLER COUNTY

CRIPPLE CREEK DISTRICT

The Cripple Creek district yielded 28 percent of the total gold production of the State in 1945. From 1891, when gold was discovered in the area, through 1945 the district has yielded 18,525,259 fine ounces of gold valued at $401,958,547, or 48 percent of the State total output of gold from 1858 to 1945, inclusive. The total production of ore from Cripple Creek mines and dumps in 1945 was 129,770 tons, all treated in the Golden Cycle mill (see El Paso County).

MINES REVIEW

Operations of the Golden Cycle Corp., which owns and operates the Golden Cycle mill at Colorado Springs and several mines in the Cripple Creek district, are described in the following extract from its annual report to stockholders for the year ended December 31, 1945 (dated March 25, 1946):

We have endeavored to keep stockholders fully informed about War Production Board Order L–208 and its effect upon our activities. This order was repealed July 1, 1945, but its removal did not bring the immediate relief we had hoped for. The drastic shortage of labor, miners, and materials for all our operations continued throughout the year. We hope these conditions will become better during 1946 and that we can start the long road back to the resumption of normal operations.

Production of strategic metals.—(1) During 1945 a total of 96,112 tons of complex ore with a total gross value of $702,234.76 was purchased from shippers for the production of zinc-lead concentrates. It is significant to note that the complex ore purchased during this period contained the following strategic metals: 14,882,879 pounds of zinc; 6,292,547 pounds of lead; 808,296 pounds of copper; 414,845 ounces of silver; and 3,785 ounces of gold; gross value $702,234.76.

(2) During the year 10,904 tons of zinc concentrates were shipped to smelters of the American Zinc Co. at Dumas, Tex., and Carondelet, Ill.; and 4,914 tons of lead concentrates were shipped to the American Smelting & Refining Co. at Leadville, Colo.

(3) Zinc-lead ore for treatment at the Golden Cycle mill at Colorado Springs was received during the year from mines located in and near Leadville, Montezuma, Kokomo, the Bonanza district, Alma, Clear Creek County, San Juan County, and other mineralized areas of Colorado.

(4) During the summer of 1945 the Golden Cycle Corp. engaged on its own account in the mining of lead-zinc ore on the Monte Cristo property, located near the top of Hoosier Pass, Summit County, Colo.

(5) Some royalty was received from the Wilson group of mining claims, located in the Kokomo mining district, near Leadville, Colo., a portion of which is now under lease to the American Smelting & Refining Co.

Gold-mining operations. Ajax, Anchoria Leland, Cameron, and Index mines.—Gold-mining operations in the Cripple Creek mining district during 1945 reached the lowest level in the entire history of the Cripple Creek district. It was hoped that, with the lifting of War Production Board Order L–208 and the end of the war, considerable numbers of miners and lessees would quickly return to the Cripple Creek mining district. However, this did not materialize and, while the labor condition now shows some betterment, it will still be necessary for additional hundreds of miners and lessees to return to the Cripple Creek district before normal operations can be resumed.

Total ore production from the Cripple Creek mining district during 1945 shipped to the Golden Cycle mill at Colorado Springs was 129,770 tons, with an average value of $8.719 per ton and total gross value of $1,131,502. Of this total tonnage Golden Cycle mine properties produced 31,645 tons with an average per ton value of $12.21. Of the 31,645 tons, 10,792 tons came from the Granite dump at the Ajax mine. The average value of the dump ore was only $3.32 per ton, but this tonnage was shipped to help maintain sufficient tonnage for the operation of the Midland Terminal Railroad and the Golden Cycle mill.

Operating as a lessee, the Golden Cycle Corp. also shipped, from the Theresa dump, owned by the United Gold Mines Co., 44,940 tons of dump ore, with an average value of $3.25 per ton.

Of the total ore received by the Golden Cycle mill during the year, 75 percent was dump ore, and this fact accounts for the low average per ton value of the gold ore treated at the mill during the past year.

Ajax operation.—During 1945 the Ajax operations were greatly curtailed due to the shortage of men and materials. However, a special effort was made to do as much development work as possible. During the year 4,692 feet of drifts, crosscuts, and raises were completed, and the result of this development work was satisfactory since a number of ore shoots were opened up in the lower levels of the mine. During the year 11,868 tons of ore with an average value per ton of $20.90 were shipped to the mill. In the same period Ajax lessees shipped 5,710 tons of ore with an average value of $13.06 per ton.

Preparations to commence stoping ore are now being made, particularly on the 27th level of the mine, and we hope that during 1946 the production from the Ajax will be increased over 1945.

Anchoria Leland.—During 1945 the entire production of this property was accounted for by lessees. The company did not work on the property except to maintain and operate the shaft for the accommodation of split-check lessees. Lessees' production during the year amounted to 3,247 tons with an average value of $8.52.

Cameron and Index.—No work was done on either of these two properties during the year.

Summary of gold mining operations.—It is still impossible to forecast with any certainty the immediate future of our corporation. It is hoped that during 1946 miners and lessees will return to the Cripple Creek district at an accelerated rate. Without sufficient manpower we cannot expect to get our properties back upon a normal basis.

The gold-mining industry is also faced with added labor and material costs, and these factors, coupled with the fact that the selling price of gold is fixed by the Government, furnish an added hardship for us to overcome.

Carlton drainage tunnel.—The Carlton drainage tunnel functioned perfectly during 1945 and no trouble of any kind was experienced with its operation. The water flow remained constant during the year at approximately 4,500 gallons of water per minute. The value of this tunnel both to present and to future operations of the Cripple Creek mining district cannot be overestimated. Because of the drainage from the tunnel we were enabled during 1945 to work the lower levels of the Ajax and Portland mines and the best grade of ore shipped from the Cripple Creek mining district during the year was from these properties.

The annual report of the United Gold Mines Co., an operating and holding company for property scattered throughout the Cripple Creek district, for the year ended December 31, 1945 (dated February 1, 1946), gives the following details on operations at individual mines:

Operating loss in 1945 was $408 vs. operating loss in 1944 of $16,792, or a betterment of $16,384. Production from the United Gold Mines properties during the year was 82,893 tons with a gross value of $553,062, or an average of $6.67 per ton. This compares to production in 1944 of 67,885 tons with a gross value of $478,455, and an average value of $7.05 per ton. Of the 1945 production 44,940 tons with a total gross value of $146,228, and an average per ton value of $3.25 was shipped from the Theresa dump. While the production for 1945 was somewhat better than 1944 the production was still far below normal in both tonnage and value

The Cripple Creek district is still badly in need of miners and lessees. It was hoped that men would return to the district in large numbers after VJ-day, but this has not materialized. The latter part of 1945 there was a slight betterment in the numbers of miners and lessees returning to the Cripple Creek mining district, but the return is very slow and the Cripple Creek district still suffers from a drastic lack of manpower. Some betterment has taken place in the number of lessees operating on United Gold Mines property and it is hoped during 1946 that additional operators will be interested in leasing various portions of our properties.

Many of our properties did not operate during the year. A résumé of the chief operations which were carried on is as follows:

Portland operation.—Operations carried on through Portland No. 1 and No. 2 shafts showed an improvement over preceding year. The number of sets of lessees increased from eight in January 1945 to fourteen in December 1945. Company operations were carried on in the lower levels of No. 2 shaft at a fairly constant rate throughout the year. 928 feet of development work was done.

Pulling old stope fill together with a limited amount of stoping accounted for 6,596 tons of ore with an average value of $13.23 per ton.

Lessees accomplished 1,820 feet of development work and shipped 4,244 tons of ore, with an average value of $36.47 per ton. This is the highest average value of lessee ore from the Portland in many years and was due to the fact that one lessee shipped in the early part of 1945 a considerable tonnage of exceptionally high-grade ore.

Vindicator operation.—The Vindicator shaft was closed down almost two months during the year while the hoist was overhauled and a new main shaft installed.

Lessees shipped 10,835 tons of ore, with an average value of $6.37 per ton. The company shipped 1,384 tons with an average value of $3.75 per ton.

Lessees accomplished 1,309 feet of development work during the year. No company development work was done during 1945.

Miscellaneous operations.—The Rose Nicol was closed down during the entire year, due to the lack of sufficient manpower to operate.

The Patti Rosa was the only property on Bull Hill to operate throughout the year and accounted for most of the ore shipped from the Bull Hill group of the United Gold Mines.

A fair tonnage of crushed rock was shipped during the year. This production also resulted in the company shipping 3,754 tons of rock screenings with an average value of $4.96 per ton.

Production of company ore by United Gold Mines Co. in 1945

Mine	Net tons	Gross value [1]	Company ore cash receipts	Average gross value per ton [1]
Vindicator	1,384	$5,193	$1,167	$3.75
Rose Nicol	87	567	280	6.56
Portland	6,596	87,266	54,768	13.23
No. 2 Plant	3,754	18,611	7,198	4,96
Theresa-Cycle Dump	44,940	146,228	11,235	3.25
	56,761	257,865	74,648	4.54

[1] Gross value calculated at settlement value.

Production of lessee ore of United Gold Mines Co. in 1945

Group	Net tons	Gross value [1]	Royalties received	Lessees' receipts	Average gross value per ton [1]
Vindicator	10,835	$69,025	$12,968	$19,724	$6.37
Rose Nicol	39	268	12	123	6.87
Portland	4,244	154,799	64,911	62,765	36.47
Bull Hill Group	11,013	71,105	3,807	29,625	6.46
	26,131	295,197	81,698	112,237	11.30

[1] Settlement value.

Production of properties of United Gold Mines Co. before and after organization of the company (May 15, 1902) to Dec. 31, 1945

	Net tons	Gross value [1]
Ore mined before consolidation	26,310	$456,806
Production under operation of United Gold Mines Co.	2,619,202	26,115,913
Total to Dec. 31, 1945	2,645,512	26,572,719

[1] Settlement value.

The annual report of the Cresson Consolidated Gold Mining & Milling Co. for the 12 months ended December 31, 1945 (dated February 1, 1946), says—

PRESIDENT'S REPORT

No mining was carried on in the Cresson mine during 1945 due principally to the continued drastic labor shortage. While the labor situation has become somewhat better in the Cripple Creek mining district since VJ-day, there are still insufficient men available to start up and operate the property. Competition of nearby areas has kept much labor from returning to the district. We hope by mid-1946 labor and other conditions will have improved sufficiently to permit us to reopen and continue operating the property.

During the year maintenance work was continued and retimbering of the main shaft completed. The shaft is now in the best condition it has been in for 25 years. Much work was also done on the ore house and bins. These improvements are of a permanent nature and should last for many years. Timber foundations under the ore house and ore bins for the past years have been a steady source of difficulty and expense and it is expected that the new work done during 1945 should eliminate much trouble and expense.

Before the mine can be reopened several weeks of repair work on the hoist and boilers will be necessary. This will be done as soon as possible so the mine will be in readiness to reopen when sufficient labor is available.

When the Cresson property is reopened development work will be of the utmost importance. The upper levels above the Roosevelt drainage tunnel have been operated for many years and cannot be expected to produce ore in the same quantities as in the past. The area between the Roosevelt and Carlton drainage tunnels must be developed as the primary source of ore for future years. One of the first major development projects which should be carried out is to drive the lateral on the Carlton drainage tunnel level from the Portland shaft to the Cresson ground so complete drainage can be had. The length of this lateral will be approximately 4,000 feet.

During 1945 only 1,622 tons of ore with a gross value of $28,222 was shipped by lessees and the company. Part of this ore was mined by lessees working through the Rose Nichol shaft on the Cresson property and part was clean-up from under the Cresson ore bins.

Production of Cresson Consolidated Gold Mining & Milling Co., 1903 to Dec. 31, 1945

Period	Dry short tons	Gross value [1]	Freight and treatment	Net value
1903 to Dec. 31, 1944	3,216,736	$46,443,045	$15,342,779	$31,100,266
1945:				
Company ore	192	4,227	1,344	2,883
Lessee ore	1,430	23,995	8,107	15,888
1903 to Dec. 31, 1945	3,218,358	46,471,267	15,352,230	31,119,037

See footnotes at end of table.

Production of Cresson Consolidated Gold Mining & Milling Co., 1903 to Dec. 31, 1945—Continued

Period	Royalties received by company	Amount paid lessees	Average gross value per ton	Average net value per ton	Dividends
1903 to Dec. 31, 1944			$14.44	$9.67	$13,564,673
1945:					
Company ore			21.90	14.94	
Lessee ore	$2,787	$13,101	16.78	11.11	
1903 to Dec. 31, 1945			14.44	9.67	[2] 13,564,673

[1] Settlement value.
[2] Represents 29.19 percent of gross value and 43.59 percent of net value.

Shipments from the Stratton Estate properties in 1945 totaled 3,816 tons of gold ore produced by lessees on the Logan, Specimen, War Eagle, Porcupine, and Proper claims in the Bull Hill group and Block 107 in the Globe Hill group of mines. Other producing mines and dumps in the Cripple Creek district in 1945 included, in order of production, the Mary McKinney, Tenderfoot group, Joe Dandy, Mary Cashen, Queen, School Section, Empire Lee, Dr. Jackpot, New Gold Dollar, Free Coinage, and Home & Homestead.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN THE EASTERN STATES

(MINE REPORT)

By A. J. Martin

SUMMARY OUTLINE

SUMMARY

The most significant events of 1945 affecting metal mining were the surrenders of Germany in May and of Japan in August, which removed military necessity as the governing factor in many phases of mining operations. To the end of the year, however, there had been no substantial change in mine-production rates of gold, silver, copper, lead, or zinc in the Eastern States. The yearly output of each of these metals was lower in 1945 than in 1944, owing mainly to the cumulative adverse effect of prolonged curtailment of development work, caused by manpower shortage, and the fact that the most crippling stage of the mine labor shortage came in 1945. The quantity of zinc produced decreased 11 percent from 1944 and was the lowest since 1934. Notwithstanding the drop in zinc production, the Eastern States contributed 25 percent of the total United States mine output, as in 1944. The Eastern States production of the other four metals is comparatively small; in recent years it has been 1 or 2 percent of the total domestic output for copper and lead and less than 1 percent for gold and silver. War Production Board Limitation Order L–208 was revoked, effective July 1, 1945, but this action had not resulted in the reopening of any important gold mine in the Eastern States by the end of the year. Nearly all the gold and silver output was recovered as a byproduct of the mining of other metals.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported, except that of zinc in New Jersey, has been calculated at the prices in the following table. The value of the New Jersey output is the total value of the zinc recoverable as metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Annual figures for the 5 years ended with 1945 are given in the table that follows. The figures for tonnage of ore sold or treated do not include magnetite ore containing pyrite and chalcopyrite, from which copper, gold, and silver were recovered as byproducts.

Mine production of gold, silver, copper, lead, and zinc in the Eastern States, 1941–45, in terms of recovered metals

Year	Mines producing		Ore sold or treated (short tons) [1]	Gold (lode and placer) [2]		Silver (lode and placer) [3]	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	43	14	3,780,397	21,982	$769,370	106,051	$75,414
1942	36	17	4,130,226	14,699	514,465	105,307	74,885
1943	29	3	4,211,961	2,878	100,730	128,129	91,114
1944	26	2	4,202,461	2,595	90,825	124,006	88,182
1945	24	----------	3,718,073	1,857	64,995	81,983	58,299

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
1941	27,132,000	$3,201,576	5,513	$628,482	191,310	$29,484,423	$34,159,265
1942	28,404,000	3,436,884	4,475	599,650	199,809	36,190,180	40,816,064
1943	28,490,000	3,703,700	4,843	726,450	199,233	39,225,222	43,847,216
1944	30,098,000	4,063,230	6,266	1,002,560	176,327	35,977,536	41,222,333
1945	24,910,000	3,362,850	5,159	887,348	156,269	31,520,742	35,894,234

[1] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.
[2] Includes placer gold as follows: 1941, 203 ounces; 1942, 69 ounces; 1943, 12 ounces; 1944, 5 ounces.
[3] Includes placer silver as follows: 1941, 15 ounces; 1942, 2 ounces; 1943–45, none.

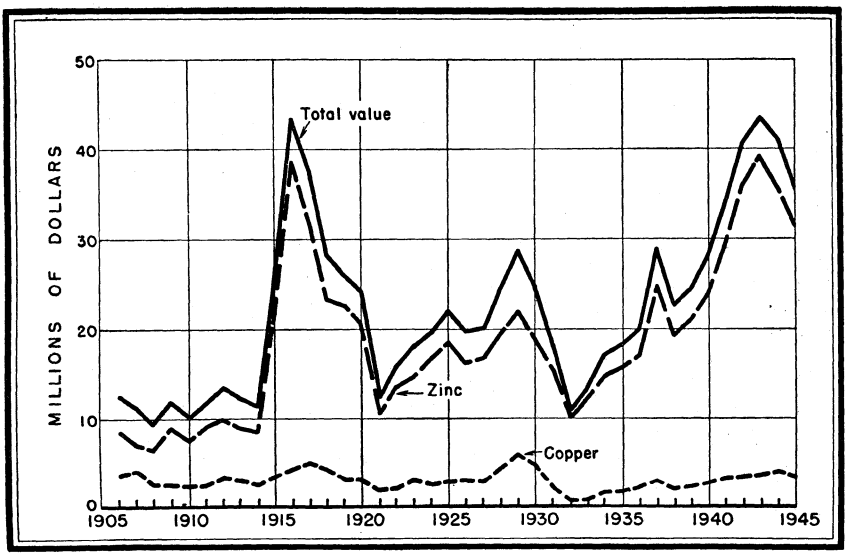

FIGURE 1.—Value of zinc and copper and total value of gold, silver, copper, lead, and zinc in the Eastern States, 1906–45. The combined value of gold, silver, and lead has not exceeded $1,485,660 annually in any year of the period.

Mine production of gold, silver, copper, lead, and zinc in the Eastern States in 1945, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
January	162	7,438	993	495	14,572
February	155	8,237	939	393	12,360
March	181	9,760	1,086	487	13,853
April	180	7,716	1,078	533	12,714
May	143	4,187	1,018	440	13,497
June	121	4,260	1,015	284	13,547
July	132	3,418	1,044	295	11,814
August	138	3,473	1,034	279	12,461
September	191	12,299	1,038	434	12,554
October	139	7,528	1,045	568	14,533
November	154	6,324	1,001	516	13,131
December	161	7,343	1,164	435	11,233
	1,857	81,983	12,455	5,159	156,269

Gold.—Revocation of WPB Limitation Order L–208, effective July 1, 1945, resulted in little immediate expansion of activity in gold mining in the Eastern States. Most of the gold produced in 1945, as in the 2 preceding years, was recovered as a byproduct from magnetite-pyrite-chalcopyrite ore from the Cornwall mine in Lebanon County, Pa. The gold from this mine was contained in copper concentrates shipped to the Phelps Dodge smelting and electrolytic-refining plant at Laurel Hill, N. Y. A little gold was recovered from copper-iron ore from the Tennessee Copper Co. mines in Polk County, Tenn., from copper ore from the Elizabeth mine in Orange County, Vt., from zinc-lead ore from the Valzinco mine in Virginia (closed in January), and from old tailings from the Hog Mountain gold mine in Alabama.

The principal producers of gold when the wartime shut-downs occurred in 1942 were the Haile gold mine in Lancaster County, S. C., and the Condor (old Howie) in Union County, N. C., both equipped with cyanidation mills. The estimated output of gold in the Southern Appalachian States from 1799 to 1945 is recorded as follows:

Mine production of gold in the Southern Appalachian States, 1799–1945

State	Period	Fine ounces	Value	State	Period	Fine ounces	Value
Alabama	1830–1945	49, 494	$1, 198, 950	South Carolina	1829–1945	318, 801	$7, 562, 125
Georgia	1830–1945	870, 526	18, 084, 257	Tennessee	1831–1945	20, 870	478, 080
Maryland	(1) –1945	6, 102	163, 940	Virginia	1828–1945	167, 558	3, 577, 509
North Carolina	1799–1945	1, 164, 588	24, 327, 843	Total	1799–1945	2, 597, 939	55, 392, 704

[1] Year of first production not recorded.

Silver.—The mine output of silver in the Eastern States in 1945 comprised 56,370 ounces recovered from copper and copper-iron ores from Tennessee, Vermont, and Virginia; 15,178 ounces from zinc-lead ore from New York and Virginia; 10,434 ounces from magnetite-pyrite-chalcopyrite ore from Pennsylvania; and 1 ounce from old gold-silver tailings from Alabama.

Copper.—The Ducktown district in Polk County, Tenn., is the principal copper-producing district in the Eastern States. There were four producing mines in this district in 1945, all owned and operated by the Tennessee Copper Co. The ore contains heavy sulfides of iron, copper, and zinc; in recent years the values of both the iron and the sulfur (recovered as sulfuric acid) have exceeded the value of the copper. The Pennsylvania output of copper was recovered as a byproduct of iron mining at the Cornwall mine of the Bethlehem Steel Co. in Lebanon County. The ore contains chiefly magnetite but carries pyrite and chalcopyrite, which are treated by flotation to produce pyrite concentrates and copper concentrates. The Vermont production continued to come from the Elizabeth copper mine in Orange County, operated by the Vermont Copper Co. Nearly all the 70 tons of copper shown for Virginia was contained in copper ore shipped from the Toncrae mine in Floyd County; a few tons were recovered from zinc-lead ore mined in January from the Valzinco property in Spotsylvania County.

Lead.—The lead output of the Eastern States in 1945 was derived chiefly from zinc-lead sulfide ore from the Austinville mine in Virginia and zinc-iron-lead sulfide ore from the Balmat in New York. The other lead-producing mines were the Embree in Tennessee, which shipped lead carbonate concentrates in December, and the Valzinco zinc-lead mine in Virginia, operated in January only. The total output of recoverable lead was 5,159 tons in 1945, a decrease of 18 percent from 1944.

Zinc.—The mine production of recoverable zinc in the Eastern States in 1945 was 156,269 tons—a decrease of 11 percent from 1944 and 22 percent from the record output of 199,809 tons in 1942 and the almost equally high output (199,233 tons) in 1943. In New Jersey, the leading producer in the Eastern States, production of zinc recoverable as metal or in oxide amounted to 81,392 tons in 1945 compared with 80,288 tons in 1944 and 92,864 tons in 1943. The output in Tennessee decreased from 41,766 tons in 1943 to 40,831 tons in 1944 and 33,824 tons in 1945. The New York production, which was 46,000 tons in 1943, decreased to 35,541 tons in 1944 and 24,978 tons in 1945. The output in Virginia was 18,603 tons in 1943, 19,667 tons in 1944, and 16,075 tons in 1945. The heavy decreases in production in the past 2 years were attributed largely to labor shortage, which severely hampered mining and development operations. The average cost to the Government under the Premium Price Plan of zinc produced by mines in the Eastern States during the war was considerably lower than the average for the rest of the country. Some of the large zinc and zinc-lead mines operated from February 1, 1942, the effective date of the Premium Price Plan, through 1945 without receiving premium payments for any part of their output. In 1942 and 1943 less than 5 percent of the total "mine" value of the zinc concentrates (calculated for all concentrates upon the basis of the average grade and value reported for the New York, Tennessee, and Virginia concentrates) represented premium payments for overquota production, and in 1944 and 1945 only 7 percent represented premium payments.

MINE PRODUCTION BY STATES

Mine production of gold, silver, copper, lead, and zinc in the Eastern States in 1945, by States, in terms of recovered metals

State	Mines producing		Ore (short tons)	Gold			Silver (all lode)	
	Lode	Placer		Fine ounces, Lode	Fine ounces, Placer	Total value	Fine ounces	Total value
Alabama	1		[1] 400	5		$175	1	$1
New Jersey	2		[1] 522,177					
New York	3		325,102				14,271	10,148
Pennsylvania	1		(2)	1,588		55,580	10,434	7,420
Tennessee	13		2,337,114	148		5,180	35,391	25,167
Vermont	1		82,943	104		3,640	20,586	14,639
Virginia	3		450,337	12		420	1,300	924
	24		[3] 3,718,073	1,857		64,995	81,983	58,299
Total, 1944 [4]	26	2	[3] 4,202,461	2,590	5	90,825	124,006	88,182

[1] Alabama, all old tailings; New Jersey includes 5,952 tons old tailings.
[2] Ore is magnetite-pyrite-chalcopyrite, flotation copper concentrates from which yielded gold, silver, and copper; Bureau of Mines not at liberty to publish figures for ore and copper.
[3] Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.
[4] Includes output from Georgia as follows: 2 placer mines; gold produced, 5 ounces, value, $175; and output from North Carolina as follows: 3 lode mines; ore treated, 6,438 tons; gold produced, 21 ounces, value, $735; silver, 1,461 ounces, $1,039; copper output, included under Tennessee.

Mine production of gold, silver, copper, lead and zinc in the Eastern States in 1945, by States, in terms of recovered metals—Continued

State	Copper		Lead		Zinc		Total value
	Pounds	Value	Short tons	Value	Short tons	Value	
Alabama							$176
New Jersey					81,392	[5] $14,299,032	[8] 14,299,032
New York			862	$148,264	24,978	5,744,940	5,903,352
Pennsylvania	(6)	(6)					[7] 63,000
Tennessee	[6] 24,770,000	[6] $3,343,950	54	9,288	33,824	7,779,520	[8] 11,163,105
Vermont	(6)	(6)					[7] 18,279
Virginia	140,000	18,900	4,243	729,796	16,075	3,697,250	4,447,290
	24,910,000	3,362,850	5,159	887,348	156,269	31,520,742	35,894,234
Total, 1944 [4]	30,098,000	4,063,230	6,266	1,002,560	176,327	35,977,536	41,222,333

[4] Includes output from Georgia as follows: 2 placer mines; gold produced, 5 ounces, value, $175; and output from North Carolina as follows: 3 lode mines; ore treated, 6,438 tons; gold produced, 21 ounces, value, $735; silver, 1,461 ounces, $1,039; copper output, included under Tennessee.
[5] Estimated smelting value of recoverable zinc content of ore after freight, haulage, smelting, and manufacturing charges are added.
[6] Pennsylvania and Vermont included under Tennessee; Bureau of Mines not at liberty to publish separate figures.
[7] Excludes value of copper, which is included under Tennessee.
[8] Includes also value of copper from Pennsylvania and Vermont.

MINING INDUSTRY

The total output of ores and old tailings yielding gold, silver, copper, lead, or zinc in the Eastern States, excluding magnetite-pyrite-chalcopyrite ore from Pennsylvania, was 3,718,073 tons in 1945 compared with 4,202,461 tons in 1944. The principal factor in the decreased output in 1945 was the accentuated shortage of labor. No gold ore was mined during the year, but 400 tons of old tailings were re-treated at the Hog Mountain gold mine in Alabama. The output of copper ore (includes copper-iron-zinc ore from Tennessee and copper ore from Vermont and Virginia) decreased 3 percent from 1944, and that of zinc and zinc-lead ores together decreased 15 percent. Most of the ores yield byproducts (besides gold and silver), the values of which are not shown in the tables of this chapter but which would have to be considered to show the full value of the crude ore mined. Copper-iron-zinc ore from Tennessee and zinc-iron-lead ore from New York yield pyrite concentrates that are used in the manufacture of sulfuric acid; the Tennessee pyrite concentrates also yield iron sinter, which is sold to iron and steel producers. Sulfuric acid is made from gases produced in roasting zinc sulfide concentrates from zinc and zinc-lead ores of Tennessee, New York, and Virginia. New Jersey zinc ore yields a residue which is treated further for the recovery of other metals; and zinc ore milled in Tennessee yields a commercial tailing, some of which is sold for its lime content and some for use in concrete. The quantity of the various types of ore mined is shown in the table on ore classification that follows. Activity in exploratory drilling and development outside the producing areas was reported curtailed owing to shortage of manpower. The Bureau of Mines completed several drilling and geophysical survey projects on copper, lead, and zinc that were under way the first part of the year and made field examinations and tests of ore-treatment methods in investigating sources of strategic and critical minerals.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in the Eastern States in 1945, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (short tons)	Zinc (short tons)
Dry and siliceous gold ore	[1] 400	5	1			
Copper ore	1,097,730	252	56,370	[2] 24,896,000		(3)
Magnetite-pyrite-chalcopyrite ore	(4)	1,588	10,434	(2)		
Zinc ore	1,942,016					121,264
Zinc-lead ore	[5] 677,927	12	15,178	14,000	5,159	35,005
Total, all lode mines	[6] 3,718,073	1,857	81,983	24,910,000	5,159	156,269
Total, 1944	[6] 4,202,461	2,595	124,006	30,098,000	6,266	176,327

1 Old tailings re-treated.
2 Copper from magnetite-pyrite-chalcopyrite ore included with that from copper ore.
3 Zinc from copper ore included with that from zinc-lead ore; Bureau of Mines not at liberty to publish separate figures.
4 Bureau of Mines not at liberty to publish separate figures for ore and copper.
5 Includes small tonnage of lead ore.
6 Excludes magnetite-pyrite-chalcopyrite ore from Pennsylvania.

METALLURGIC INDUSTRY

The large copper, zinc, and zinc-lead ore-reduction mills in the Eastern States that were active in 1944 and other recent years continued running throughout 1945 but generally operated at less than capacity owing to shortage of labor in the mines. The 100-ton flotation mill at the Valzinco zinc-lead mine in Spotsylvania County, Va., built in 1942, was closed in January 1945 and was later offered as surplus property by the Reconstruction Finance Corporation for sale or lease. The ore-washing gravity-concentration plant at the Embree zinc and lead carbonate mine at Embreeville, Tenn., idle in 1944, was operated most of 1945. The methods of treatment used in the larger mills and other operating details, including the tonnage and grade of the concentrates produced by some of the mills, are given in the Review by States that follows. Most of the concentrates were shipped to smelters operated by the companies that own the mines. No amalgamation or cyanidation mills were operated during the year. At the Hog Mountain gold mine in Alabama 5 ounces of gold and 1 ounce of silver were recovered from 400 tons of old tailings concentrated in a burlap-lined sluice and amalgamated. Direct-smelting ore (1,047 tons) yielded 393 ounces of recoverable silver in 1945, and concentrates smelted (72,188 tons) yielded 1,852 ounces of gold and 81,589 ounces of silver; the figures for ore and concentrates do not include material yielding no gold or silver. The total for direct-smelting ore was 145,417 tons and for concentrates (including low-grade concentrates shipped to oxide plants) 626,665 tons.

REVIEW BY STATES

ALABAMA

At the Hog Mountain mine 13 miles northeast of Alexander City, Tallapoosa County, an important producer of gold from 1934 to 1937 and in earlier periods, 400 tons of old tailings were treated experimentally in a burlap-lined sluice in 1945; the material recovered, which was shipped to the Philadelphia Mint, weighed 11.98 ounces and contained 5.34 fine ounces of gold and 0.34 fine ounce of silver.

GEORGIA

Placer gold amounting to less than 1 ounce was recovered in 1945 by individuals in Lumpkin County and sold to a dealer in Dahlonega; the gold, which was not shipped to the mint during the year, will be credited to the production of the year in which it is shipped. Late in 1945 Calhoun Mines, Inc., was reported to be preparing to do underground development work at the old Calhoun mine in Lumpkin County.

NEW JERSEY

New Jersey ranked first among the States in zinc production in 1945. Its output of recoverable zinc as metal or in oxide was 81,392 tons compared with 80,288 tons in 1944. Crude ore hoisted totaled 516,225 tons in 1945 compared with 543,007 tons in 1944. In addition to the crude ore milled in 1945, 5,952 tons of old tailings were remilled. The producing mines in both years were the Mine Hill at Franklin and the Sterling Hill at Ogdensburg, Sussex County, each of which is equipped with a mill. The commercial ore minerals comprise chiefly franklinite (a zinc-iron-manganese mineral) and willemite (zinc silicate) but also include zincite (red oxide of zinc). In reduction of the ore the franklinite is removed from the crushed ore by magnetic separators, and the willemite and zincite are concentrated on jigs and tables. The concentrates are shipped to smelting and manufacturing plants at Palmerton, Pa. The franklinite is used in the manufacture of zinc oxide and spiegeleisen, and the willemite-zincite concentrate is smelted to produce high-grade slab zinc.

The value of the New Jersey output of zinc given in the table of this chapter under the heading Mine Production by States is the combined value of the zinc recoverable in both metal and oxide after freight, haulage, smelting, and manufacturing charges are added.

In the past, copper ore, some of which contained a little silver, has been mined in New Jersey, but no output of copper or silver from mines in the State has been recorded since the annual canvass of mines began in 1907. A description of the copper deposits and a résumé of copper mining in the State are given in a recent publication.[1] Copper and lead smelters and refineries at Carteret and Perth Amboy treat ores, scrap, byproducts, and bullion from various States and foreign countries.

[1] Woodward, Herbert P., Copper Mines and Mining in New Jersey: New Jersey, Dept. of Conservation and Development, Geol. Ser., Bull. 57, Trenton, 1944, 156 pp.

NEW YORK

The mine production of recoverable zinc in New York was 24,978 tons in 1945 compared with 35,541 tons in 1944 and the record high of 46,000 tons in 1943. Lead produced in 1945 totaled 862 tons compared with 1,644 tons in 1944 and the peak of 2,434 tons in 1942. The silver output (recovered from lead concentrates made from zinc-lead ore) was 14,271 ounces in 1945, 25,238 ounces in 1944, and 38,004 ounces in 1943. No commercial mine output of gold or copper in the State has been reported during the period covered by the annual mine canvass, which began in 1907. The sharp drop in production of zinc, lead, and silver in 1944 and 1945 was due largely to manpower shortage. The producing mines were the Balmat and Edwards of the St. Joseph Lead Co., southeast and east, respectively, of Gouverneur, and the Hyatt mine of the Universal Exploration Co. near Emeryville, all in St. Lawrence County. The Balmat ore contains zinc, iron, and lead sulfides, and some silver is associated with the lead; it is mined through a 2,655-foot 40° inclined shaft (vertical depth, about 1,300 feet) and treated in the 1,200-ton selective flotation plant at the mine. The mill feed in 1945 totaled 228,062 tons; it yielded 1,425 tons of lead concentrates containing 61.75 percent lead and 12.5 ounces of silver to the ton, 32,766 tons of zinc concentrates containing 56.77 percent zinc, and 46,302 tons of pyrite concentrates containing 40.89 percent iron and about 49 percent sulfur. The Edwards mine was operated through a vertical shaft 1,560 feet deep and an underground shaft (inclined 42° from horizontal) 1,226 feet to the mine workings. Ore treated totaled 79,928 tons yielding 12,975 tons of zinc concentrates containing 59.17 percent zinc. The zinc concentrates from both mills were shipped to the company smelter at Josephtown, Pa.; the lead concentrates from the Balmat mill were shipped to the company Herculaneum, Mo., smelter. The pyrite concentrates were sold to sulfuric acid plants. The Hyatt mine is opened by a 450-foot shaft. Development work in 1945 totaled 588 feet of drifts and 465 feet of diamond drilling. The ore was treated in the 200-ton flotation mill at the mine, and the concentrates were shipped to the Donora, Pa., smelter.

There are no zinc or lead smelters in New York. The Phelps Dodge Refining Corp. has a custom copper smelter and an electrolytic refinery at Laurel Hill, which treat copper ore, matte, bullion, and copper-bearing scrap material.

NORTH CAROLINA

No mine output of gold, silver, or copper was reported from mines in North Carolina in 1945, and the output in 1944 was small. The State has produced no recoverable lead since 1938 and no zinc since 1913. The largest producer of gold in the State when the wartime shut-downs occurred in 1942 was the Condor (old Howie) mine near Waxhaw, Union County. The Fontana mine in Swain County, principal producer of copper in recent years, was closed January 31, 1944.

PENNSYLVANIA

The Bethlehem Steel Co. continued in 1945 to recover gold, silver, and copper as byproducts of iron mining at its Cornwall mine in Lebanon County, Pa. The mine is developed by an open pit and three inclined shafts 1,700 feet deep. The ore is crushed to about 1-inch size at the shafts in Cornwall and shipped in 70-ton hopper-bottom railroad cars to the combined magnetic concentration and flotation mill at Lebanon. The daily capacity of the mill in 1945, which varied slightly from that reported for 1944, was 6,000 tons for the magnetic separation equipment and 2,200 tons for the flotation equipment. Other equipment includes a 2,400-ton sintering plant which handles part of the magnetic concentrates; the rest is shipped to another plant at Bethlehem. The flotation equipment treats tailings from the magnetic separators for the recovery of copper concentrates, which contain most of the gold and silver, and pyrite concentrates, which contain cobalt. The copper concentrates are shipped to the Phelps Dodge smelter and eletrolytic refinery at Laurel Hill, N. Y., and the pyrite concentrates to plants outside the State for recovery of sulfur (as sulfuric acid) and cobalt; the final pyrite residue is sintered and shipped to an iron and steel plant.

The zinc mines in Pennsylvania have been idle for many years. The deposits in the Saucon Valley, Lehigh County, were worked extensively from 1853 to 1876.[2] The only activity reported in recent years was exploratory drilling totaling 2,367 feet in 5 holes done by the Bureau of Mines from September 1943 to January 1944 on the Correll property in the Friedensville district. Zinc smelters at Donora, Langeloth, Josephtown, and Palmerton treat the largest part of the zinc concentrates produced in the Eastern States, as well as large tonnages from the Central States and foreign countries. There is a roasting plant for concentrates at New Castle and an electrogalvanizing plant for sheets at Johnstown that uses roasted zinc concentrates.

SOUTH CAROLINA

The wartime shut-down of the gold mines in South Carolina continued throughout 1945. From 1937 to 1942 the State ranked first among the Eastern States in gold production; the principal producer was the Haile mine in Lancaster County, equipped with a 400-ton cyanide mill.

TENNESSEE

The output of recoverable zinc in Tennessee in 1945 was 33,824 tons compared with 40,831 tons in 1944 and the peak of 43,971 tons in 1942. The decline in production since 1943 was due to labor shortage, caused in large part by migration of workers to the Oakridge atom-bomb plant and other war plants near Knoxville. The output of lead was 54 tons in 1945 and none in 1944; the peak output was 2,531 tons in 1917, nearly all from the Embreeville district. The production of copper, gold, and silver was less than in 1944. The gold and silver were recovered as byproducts from copper-iron-zinc sulfide ore from the mines of the Tennessee Copper Co. at Ducktown, Polk County.

[2] Geological Survey, Mineral Resources, 1882, pp. 361-365.

The mines operated during the year were the Burra Burra, Boyd, Calloway, and Eureka. The ore from the Boyd and Calloway mines and the upper levels of the Burra Burra was hoisted through the 1,600-foot Burra Burra shaft and that from the lower levels of the Burra Burra through the 2,400-foot (vertical) McPherson shaft. The ore-hoisting shaft at the Eureka mine is 750 feet. Other shafts were used for ventilation and service. Development work done in 1945 totaled 34 feet of shaft, 10,437 feet of drifts, and 49,568 feet of diamond drilling. Other work included geological studies, aerial photographs, mapping, and magnetometer surveys over a 3- by 5-mile area covering most of the district. Most of the ore mined was concentrated by selective flotation in the London and Isabella mills, which together have a daily capacity of 2,000 tons. Some of the ore was smelted direct in a blast furnace in the company smelter at Copperhill. The copper concentrates from the mills were smelted in a reverberatory furnace. The matte from the reverberatory and blast furnaces was treated in a converter. Most of the blister copper from the converter was cast into pigs and shipped to an electrolytic refinery on the Atlantic seaboard where some gold and silver were recovered as byproducts. Shot copper was produced for use in the company sulfate plant at Copperhill. The iron concentrates were used in making sulfuric acid in company plants at Copperhill and Isabella; they also yielded iron sinter, which was sold to iron and steel plants. The zinc concentrates were shipped mostly to the Donora, Pa., smelter. The smelter slag is screened and sized for sale, mostly as railroad ballast, road material, and concrete aggregate; some of it is granulated and sized for roofing granules.

The principal zinc mines in Tennessee are at Mascot, New Market, and Jefferson City, 14, 23, and 28 miles, respectively, northeast of Knoxville. Those operated by the American Zinc, Lead & Smelting Co. in 1945 comprised the Mascot No. 2 in Knox County and the Grasselli, Jarnagin, Mossy Creek, and Shallow Ore in Jefferson County. The Mascot is opened by a 520-foot shaft and an inclined shaft from the 520-foot level to the maximum depth of 850 feet; it also has an auxiliary manway shaft and a ventilating shaft. The Grasselli has one operating shaft and an auxiliary manway shaft and is 350 feet deep. The Jarnagin has one operating shaft 280 feet deep, with an auxiliary manway shaft. The Mossy Creek is opened by a 249-foot incline shaft. The Shallow Ore is developed by two open pits, one of which is more than 100 feet deep. All the mines are fully mechanized. Slushing is the principal method of underground loading, and power shovels, bulldozers, and heavy-duty trucks are used in loading and haulage in the open pits. Development at the five mines in 1945 totaled 6,858 feet of drifts and raises, 33,302 feet of diamond drilling, and 4,924 feet of churn drilling. The crude ore from all five mines was treated in the company mill at the Mascot No. 2 mine. The ore from the four mines in Jefferson County was transported to the mill over the Southern Railway. The mill is equipped with a differential-density cone unit, jigs, and flotation machines and has a daily capacity of 4,000 tons. In 1945 it treated 1,119,569 tons of crude ore yielding 45,520 tons of 61-percent zinc concentrates compared with 1,339,862 tons in 1944 yielding 55,690 tons of concentrates of nearly the same grade. The following data are extracted from the annual company report to stockholders: The reduction in tonnage of crude ore mined in 1945 was caused by manpower shortage. Drilling results were very satisfactory. Additional ore reserves proved on company-owned properties in Knox and Jefferson Counties are expected to produce 64,625 tons of concentrates. During the year the company purchased mineral rights on properties near Friends Station, Jefferson County, as sufficient ore was proved to warrant the major development required to bring the property into production. Development work, however, will not be started until the supply of manpower improves substantially. Company reserves of proved and indicated ore at this time are the highest heretofore recorded for Tennessee. The ore reserves on the Grasselli property were reduced by 8,145 tons. The Shallow Ore mine, a substantial producer in 1944 and 1945, will be worked out during the first half of 1946.

The Universal Exploration Co. operated its Davis-Bible mine and 800-ton mill at Jefferson City throughout 1945. The mine is opened by two shafts 180 and 240 feet deep. Mining and development continued to be hampered by the acute labor shortage, and the output of ore was much less than the normal capacity of the mine. Development during the year totaled 620 feet of drifts, 6,831 feet of diamond drilling, and 9,383 feet of churn drilling. Additional mine-car loaders and slusher hoists were installed underground. The mill is equipped with crushers, rod mills, and flotation machines. The concentrates produced averaged 64.08 percent zinc. The company continued developing the Straight Creek mine near New Tazewell, Claiborne County. In the Embreeville district, Washington and Unicoi Counties, the Tennessee Zinc Co. resumed mining zinc and lead carbonate ores. Development during the year included four shafts 25, 30, 75, and 95 feet deep; drifting from the shafts; and 200 feet of tunnels. The deepest shaft was sunk on a body of lead carbonate ore in the Lick Log area; mining through this shaft was begun in November. Shipments of zinc concentrates were made in February, April, and each month after June. Concentration is accomplished by washing, jigging, tabling, and drying. In Cannon County the Hoover mine of Gant Gaither east of Murfreesboro, equipped with a 25-ton mill, produced about a car of 58-percent zinc concentrates monthly. The Bureau of Mines did exploratory drilling in the Powell River area of Claiborne County and trenching on the Brown-Tipton property in Greene County during the first part of the year.

VERMONT

The Vermont output of gold, silver, and copper in 1945 came from the Elizabeth copper mine at South Strafford, Orange County. The mine has been operated continuously since October 1943 by the Vermont Copper Co., Inc.[3] The last previous operation was by the National Copper Corp., which closed the mine in June 1930 owing to the low price of copper. The mine is developed by a haulage adit about 1,200 feet long, an underground 30° inclined shaft 925 feet long, and four main levels opening up the vein. The ore minerals

[3] Jacobs, Elbridge C., The Vermont Copper Co., Inc.: Report of State Geologist on Mineral Industries and Geology of Vermont, 24th of series, 1943–44, pp. 1–13, (Office of State Geologist, Burlington; Fleming Museum, University of Vermont, December 1944.)

are chalcopyrite and pyrrhotite, carrying some silver and a little gold. The gangue minerals are quartz, feldspar, and mica. The ore is treated by flotation in the 500-ton mill at the mine. The concentrates averaged 22.56 percent copper and 0.012 ounce of gold and 2.50 ounces of silver to the ton; they were shipped to the Phelps Dodge smelter at Laurel Hill, N. Y.

VIRGINIA

Mines in Virginia yielded 16,075 tons of recoverable zinc and 4,243 tons of lead in 1945 compared with 19,667 and 4,622 tons, respectively, in 1944. The Austinville mine in Wythe County, which has been in continuous operation since 1924, contributed the bulk of the State output of both metals; the ore is treated in the 2,000-ton flotation mill at the mine. The Valzinco zinc-lead mine near Paytes in Spotsylvania County, reopened by Panaminas, Inc., in September 1942 and operated throughout 1943 and 1944, was closed in January 1945. The mine was equipped with a 100-ton flotation mill. The ore contained, besides zinc and lead, a little gold, silver, and copper, some of which was recovered in the concentrates. The products of the mill were zinc concentrates, shipped to the Langeloth, Pa., smelter, and zinc-lead concentrates, shipped to the International, Utah, lead smelter and slag-fuming plant. The Toncrae Mining Co. operated the Toncrae copper mine in Floyd County from January through August; the ore produced, which averaged 6.16 percent copper and 0.38 ounce of silver to the ton, was shipped to the U. S. Metals Refining Co. at Carteret, N. J. In September the company began building a plant at the mine to heap-roast and leach the ore and precipitate the copper.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN IDAHO

(MINE REPORT)

By C. E. NEEDHAM AND PAUL LUFF

SUMMARY OUTLINE

SUMMARY

Despite a 9-percent decrease in zinc output in 1945 compared with 1944, Idaho attained first place among zinc-producing States for the first time. Lead output, however, fell to a level below that for any year since 1899. This shifting prominence from lead to zinc paralleled the increasing ratio of zinc to lead in the ores of many Coeur d'Alene mines as mining reached greater depths.

Although the base prices of gold, silver, copper, lead, and zinc in 1945 were the same as those in 1944 and the premium payments for overquota production of copper, lead, and zinc remained in force throughout the year, the production of each metal in Idaho in 1945 was less than that in 1944; in fact, the production of gold was the smallest since 1927; silver, the smallest since 1934; copper, the smallest since 1936; and zinc, the smallest since 1941. The principal cause of the 1945 decreases was the shortage of labor. Production in 1945 (in terms of recoverable metals) was 17,780 fine ounces of gold, 8,142,667 fine ounces of silver, 3,096,000 pounds of copper, 136,894,000 pounds of lead, and 166,926,000 pounds of zinc, indicating decreases from 1944 of 29 percent in gold, 18 percent in silver, 8 percent in copper, and 18 percent in lead. The total value of the gold was $622,300—2 percent of the State total value; silver, $5,790,341—15 percent; copper, $417,960—1 percent; lead, $11,772,884—31 percent; and zinc, $19,196,490—51 percent. The total value of the five metals was $37,799,975 in 1945 compared with $42,591,137 in 1944. About 87 percent of the State silver production, 66 percent of the copper, 93 percent of the lead, and 93 percent of the zinc came from the Coeur d'Alene region of Shoshone County; the rest of the silver, lead, and zinc came largely from the Warm Springs district in Blaine County.

About 63 percent of the State gold production came from the Warm Springs district in Blaine County and the Yellow Pine district in Valley County.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers, 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Idaho, 1941–45, and total, 1863–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	331	524	2,704,686	149,816	$5,243,560	16,672,410	$11,855,936
1942	203	236	2,900,704	95,020	3,325,700	14,644,890	10,414,144
1943	127	30	2,741,747	30,808	1,078,280	11,700,180	8,320,128
1944	112	20	3,271,038	25,008	875,280	9,931,614	7,062,481
1945	116	27	3,139,286	17,780	622,300	8,142,667	5,790,341
1863–1945			(1)	7,797,774	176,061,493	513,994,308	353,787,181

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	7,242,000	$854,556	209,828,000	$11,960,196	158,168,000	$11,862,600	$41,776,848
1942	6,860,000	830,060	227,818,000	15,263,806	174,512,000	16,229,616	46,063,326
1943	4,648,000	604,240	192,914,000	14,468,550	173,414,000	18,728,712	43,199,910
1944	3,376,000	455,760	167,060,000	13,364,800	182,744,000	20,832,816	42,591,137
1945	3,096,000	417,960	136,894,000	11,772,884	166,926,000	19,196,490	37,799,975
1863–1945	[2] 106,749	32,620,767	[2] 5,880,397	642,801,102	[2] 1,222,165	193,780,917	1,399,051,460

[1] Figures not available. [2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1945, by months, in terms of recovered metals

	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	979	785,488	280,000	12,758,000	15,680,000
February	1,379	755,488	264,000	11,804,000	14,000,000
March	1,779	954,176	412,000	13,710,000	16,614,000
April	1,779	717,488	290,000	12,842,000	14,782,000
May	1,829	787,806	300,000	12,992,000	15,976,000
June	1,254	576,138	188,000	11,720,000	14,644,000
July	1,689	645,163	208,000	10,344,000	12,696,000
August	1,379	616,624	246,000	10,378,000	10,320,000
September	1,179	510,837	224,000	9,182,000	12,430,000
October	2,079	592,487	256,000	10,254,000	12,894,000
November	879	685,487	234,000	10,304,000	12,796,000
December	1,576	515,485	194,000	10,606,000	14,094,000
	17,780	8,142,667	3,096,000	136,894,000	166,926,000

Gold and silver produced at placer mines in Idaho, 1941–45, in fine ounces, in terms of recovered metals

Year	Sluicing and hydraulic		Drift mining		Dredges						Total	
					Dry-land [1]		Dragline floating [1]		Floating bucket			
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
1941	4,899	1,149	228	46	3,185	388	11,725	2,100	52,358	13,725	72,395	17,408
1942	1,197	234	83	7	563	60	6,126	879	36,611	9,291	44,580	10,471
1943	249	69	6								255	69
1944	118	31	18								136	31
1945	168	26	8						1,593	379	1,769	405

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline floating dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

Gold.—Despite a decrease of 36 percent in output of recoverable gold from lode mines in Idaho in 1945 compared with 1944, the output from placers increased from 136 ounces to 1,769 ounces. This increase resulted from resumption, in September, of bucket dredging at Idaho City in Boise County after L–208 (the War Production Board gold-mine closing order of October 8, 1942) was rescinded July 1, 1945. The Idaho-Canadian Dredging Co. resumed operating its 7½-cubic foot bucket dredge at Idaho City in September. The yield of gold from lode mines decreased from 24,872 ounces in 1944 to 16,011 in 1945, because less gold ore was treated from the Boise-Rochester-Monarch group at Atlanta by the Talache Mines, Inc., and production of gold from the Yellow Pine mine at Stibnite and Triumph property near Hailey declined. The Bradley Mining Co., operating the Yellow Pine mine, treated gold-tungsten-antimony ore in its 800-ton flotation plant from January to July, inclusive. During the next 4 months the company treated only tungsten tailings, but in December it resumed milling gold-tungsten-antimony ore. About 81 percent of the State total gold in 1945 came from zinc-lead ore from the Triumph property, gold-tungsten-antimony ore from the Yellow Pine mine, zinc-lead ore from various mines in the Coeur d'Alene region, and bucket dredging in Boise County.

Silver.—Although Idaho's production of recoverable silver dropped from 9,931,614 fine ounces in 1944 to 8,142,667 fine ounces in 1945, the State remained the largest producer of silver in the United States—a place it has held since 1933. Large decreases in silver output were reported by the Sunshine, Coeur d'Alene (Mineral Point mine), Bunker Hill & Sullivan, Federal, Triumph, Clayton, Tamarack, Bradley (Yellow Pine mine), and Sullivan (Star mine) mining companies; however, a marked increase was made from treating old tailings from the Osburn dump by the Hecla Mining Co. The Coeur d'Alene region produced 87 percent of the State total silver in 1945; the remainder came largely from the Warm Springs, Bayhorse, Deadwood Basin, Blue Wing, Yellow Pine, South Mountain, and Clark Fork districts. Of the State total silver, zinc-lead ore and old tailings yielded 49 percent, silver ore 44 percent, lead ore 5 percent, and zinc ore and slag and gold ore nearly all the remainder. The recovery of silver from silver ore and lead ore decreased 1,379,469 ounces, owing chiefly to the decline in output of ore from property operated by the Sunshine Mining Co. The apparent increase in recovery of silver from silver ore and the decrease from lead ore in 1945 resulted from a change in the class of part of the ore mined by the Sunshine Mining Co. from lead ore in 1944 to silver ore in 1945. The State output of silver recovered from zinc-lead ore decreased 334,603 ounces owing to a decline in output of zinc-lead ore from most of the principal producers.

Ten mines—the Sunshine, Polaris, Osburn tailing plant, Bunker Hill & Sullivan, Silver Dollar, Triumph, Page, Morning, Sherman, and Star—produced more than 76 percent of the silver output of the State in 1945. All but the Triumph are in the Coeur d'Alene region.

Copper.—In 1945 about 66 percent of Idaho's copper output was recovered as a byproduct in the treatment of zinc-lead ore, silver-copper-antimony ore, silver ore, and lead ore from mines in the Coeur d'Alene region; the remainder was recovered largely from copper ore produced in the Alder Creek district and from zinc-lead ore produced in the Warm Springs district. The State copper output in 1945 was 8 percent less than that in 1944, owing principally to a decline in output of silver-copper-antimony ore from the Mineral Point mine near Osburn in Shoshone County.

The Empire mine of the Mackay Exploration Co. near Mackay was the largest producer of copper in Idaho. It was followed by the Osburn tailing plant, Sunshine, Polaris, and Triumph properties.

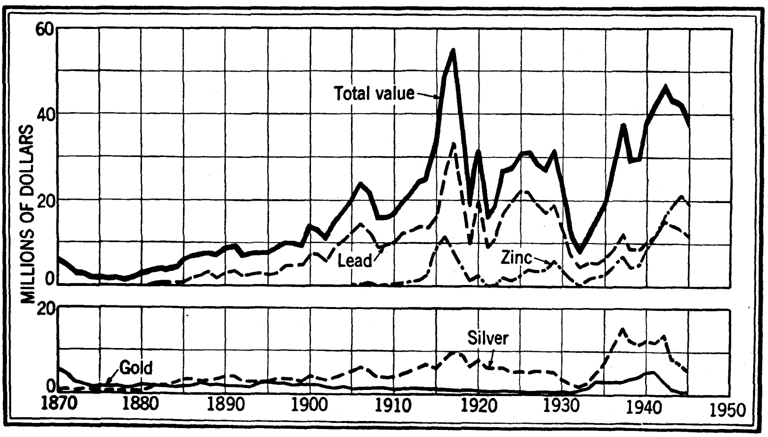

FIGURE 1.—Value of mine production of gold, silver, lead, and zinc and total value of gold, silver, copper, lead, and zinc in Idaho, 1870-1945. The value of copper has been less than $2,000,000 annually, except in a few years.

Lead.—Despite the fact that the output of recoverable lead in Idaho in 1945 (136,894,000 pounds) was the smallest since 1899, the State remained the largest producer of lead west of Missouri. Marked decreases in lead output were reported by the Federal (Page and Morning mines), Bunker Hill & Sullivan, Sunshine, Hecla (Hecla mine), Sullivan (Star mine), Tamarack, Triumph, and Clayton mining companies; however, substantial increases were made at the Osburn and Sweeny tailing dumps. Nearly 93 percent of the State total lead came from the Coeur d'Alene region; most of the remainder was produced in the Warm Springs, Bayhorse, Deadwood Basin, Lava Creek, Texas, Mineral Hill & Camas, Dome, and Clark Fork districts. Zinc-lead ore and old tailings (2,519,004 tons) from the Coeur d'Alene region yielded 81 percent of the State total lead; and lead ore and silver ore, chiefly from the Coeur d'Alene region, yielded 11 percent; the remainder came largely from zinc-lead ore in the Warm Springs district and from zinc slag in the Coeur d'Alene region. Lead recovered from lead ore decreased 19,340,076 pounds and that from zinc-lead ore and old tailings 15,280,648 pounds; but lead from silver ore increased 4,282,892 pounds and that from zinc ore and slag 158,340 pounds.

In 1945 the combined lead output of the five largest producers—the Bunker Hill & Sullivan, Osburn tailing plant, Morning, Star, and Page—was 70,131,690 pounds, 51 percent of the State total. In 1944 the combined lead output of these properties was 86,640,704 pounds. Other important producers in 1945 were the Sweeny tailing dump, Sherman, Tamarack, Triumph, Frisco, Monitor, Bunker Hill slag dump, Sunshine (Chester vein), Dayrock, Spokane-Idaho, and Polaris (Chester vein) properties.

Zinc.—The output of recoverable zinc (166,926,000 pounds) in Idaho in 1945 was 9 percent less than the record output in 1944, but again it was greater than the lead output. Nevertheless, Idaho as a zinc-producing State advanced from second place in 1944 to first place in 1945, ahead of New Jersey and Oklahoma. Marked decreases in output of zinc at the Bunker Hill & Sullivan, Page, Star, Tamarack, and Triumph properties more than offset substantial increases at the Osburn tailing plant, Bunker Hill slag dump, Sidney, Spokane-Idaho, and Daylight Lease (Interstate-Callahan) properties. More than 93 percent of the State total zinc in 1945 came from the Coeur d'Alene region and nearly all the remainder from the Warm Springs, Deadwood

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1945, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Ada	1		5	$175		
Adams	3		3	105	329	$234
Blaine	12		6,551	229,285	515,205	366,368
Boise	7	6	1,964	68,740	2,035	1,447
Bonner	3		2	70	39,721	28,246
Bonneville		1	35	1,225		
Boundary	2		279	9,765	6,719	4,778
Butte	4		97	3,395	9,900	7,040
Clark	1		1	35	495	352
Clearwater		2	22	770	7	5
Custer	13		730	25,550	217,170	154,432
Elmore	3		666	23,310	9,616	6,838
Idaho	3	11	68	2,380	83	59
Jerome		1	1	35		
Latah		1	4	140		
Lemhi	9	1	51	1,785	52,813	37,556
Owyhee	1	2	60	2,100	41,054	29,194
Shoshone	49	1	1,898	66,430	7,115,646	5,060,015
Valley	5	1	5,343	187,005	131,874	93,777
	116	27	17,780	622,300	8,142,667	5,790,341
Total, 1944	112	20	25,008	875,280	9,931,614	7,062,481

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1945, by counties, in terms of recovered metals—Continued

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Ada							$175
Adams	22,600	$3,051					3,390
Blaine	254,600	34,371	5,129,000	$441,094	6,558,000	$754,170	1,825,288
Boise			1,500	129			70,316
Bonner	1,600	216	206,000	17,716	23,800	2,737	48,985
Bonneville							1,225
Boundary	5,400	729	213,000	18,318	108,400	12,466	46,056
Butte	24,400	3,294	457,500	39,345	438,800	50,462	103,536
Clark	600	81	148,000	12,728			13,196
Clearwater							775
Custer	470,000	63,450	2,819,500	242,477	791,000	90,965	576,874
Elmore							30,148
Idaho							2,439
Jerome							35
Latah							140
Lembi	106,600	14,391	360,000	30,960	65,400	7,521	92,213
Owyhee	93,600	12,636	48,000	4,128	1,355,600	155,894	203,952
Shoshone	2,036,000	274,860	126,860,000	10,909,960	156,059,000	17,946,785	34,258,050
Valley	80,600	10,881	651,500	56,029	1,526,000	175,490	523,182
	3,096,000	417,960	136,894,000	11,772,884	166,926,000	19,196,490	37,799,975
Total, 1944	3,376,000	455,760	167,060,000	13,364,800	182,744,000	20,832,816	42,591,137

Basin, South Mountain, Lava Creek, Bayhorse, and Mineral Hill & Camas districts. Zinc-lead ore and old tailings concentrated yielded 88 percent of the State total zinc, old zinc slag smelted and fumed 11 percent, and zinc ore concentrated, lead ore concentrated, and silver ore concentrated nearly all the remainder.

Ten properties—the Star, Osburn tailing plant, Bunker Hill smelter slag dump, Morning, Page, Tamarack, Monitor, Frisco, Bunker Hill & Sullivan mine, and Triumph—produced more than 74 percent of the State total zinc in 1945.

MINING INDUSTRY

As a result of a serious labor shortage throughout 1945, base-metal mining in Idaho experienced a marked decline in output of nearly all classes of ore, especially in silver-lead ore and zinc-lead ore mined in the Coeur d'Alene region and in gold-antimony-tungsten ore mined in the Yellow Pine district. No revival at lode gold mines was noticeable during the last 7 months of the year after L–208 was rescinded July 1; however, a former large producer of placer gold (bucket dredge at Idaho City) resumed operations in October. The suspension December 19 of mining operations—resulting from a fire—on the 2,900 level of the Sunshine mine affected the State output of silver ore and lead ore. The output of zinc-lead ore and old tailings (by far the chief output of the State) increased 7 percent, siliceous gold ore declined 56 percent, lead ore decreased 57 percent, and zinc ore and slag decreased 22 percent; but siliceous silver ore increased 13 percent, and copper ore increased 165 percent. Nearly all the gold ore mined in Idaho in 1945 came from one property in the Yellow Pine district; 70 percent of the silver ore, 90 percent of the lead ore, 92 percent of the zinc ore and slag, and nearly 94 percent of the zinc-lead ore and old tailings came from various properties in the Coeur d'Alene region; and 97 percent of the copper ore came from one mine in the Alder Creek (Mackay) district.

Gold and silver produced at lode mines in Idaho in 1945, by counties, in terms of recovered metals

County	Ore sold or treated	Gold	Silver	County	Ore sold or treated	Gold	Silver
	Short tons	*Fine ounces*	*Fine ounces*		*Short tons*	*Fine ounces*	*Fine ounces*
Ada	10	5	----------	Elmore	1,866	666	9,616
Adams	68	3	329	Idaho	14	14	76
Blaine	107,461	6,551	515,205	Lemhi	33,047	43	52,813
Boise	200	329	1,644	Owyhee	7,523	58	41,054
Bonner	3,848	2	39,721	Shoshone	2,794,208	1,896	7,115,646
Boundary	6,669	279	6,719	Valley	134,185	5,337	131,874
Butte	5,360	97	9,900				
Clark	505	1	495		3,139,286	16,011	8,142,262
Custer	44,322	730	217,170	Total, 1944	3,271,038	24,872	9,931,583

Gold and silver produced at placer mines in Idaho in 1945, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Drift mining		Dredges: Dry-land[1]		Dredges: Dragline floating[1]		Dredges: Floating bucket		Total	
	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver	Gold	Silver
Boise	42	12	------	------	------	------	------	------	1,593	379	1,635	391
Bonneville	35	------	------	------	------	------	------	------	------	------	35	------
Clearwater	22	7	------	------	------	------	------	------	------	------	22	7
Idaho	46	7	8	------	------	------	------	------	------	------	54	7
Jerome	1	------	------	------	------	------	------	------	------	------	1	------
Latah	4	------	------	------	------	------	------	------	------	------	4	------
Lemhi	8	------	------	------	------	------	------	------	------	------	8	------
Owyhee	2	------	------	------	------	------	------	------	------	------	2	------
Shoshome	2	------	------	------	------	------	------	------	------	------	2	------
Valley	6	------	------	------	------	------	------	------	------	------	6	------
	168	26	8	------	------	------	------	------	1,593	379	1,769	405
Total, 1944	118	31	18	------	------	------	------	------	------	------	136	31

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline floating dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

ORE CLASSIFICATION

Details on ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Idaho in 1945, with content in terms of recovered metals

Source	Mines producing	Ore	Gold	Silver	Copper	Lead	Zinc
		Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	19	113,030	5,961	47,472	3,165	2,036	----------
Dry and siliceous gold-silver ore	3	64	363	7,164	----------	1,500	----------
Dry and siliceous silver ore	8	122,094	90	3,581,189	931,324	6,350,481	337,803
	30	235,188	6,414	3,635,825	934,489	6,354,017	337,803
Copper ore	7	8,569	532	8,968	483,229	----------	----------
Lead ore	33	107,511	79	435,979	75,277	8,276,865	534,016
Lead-copper ore	1	67	1	11,142	5,357	24,996	1,196
Zinc ore	3	[1] 100,039	59	74,402	93,600	3,303,000	19,429,775
Zinc-lead ore	54	2,687,912	8,926	3,975,946	1,504,048	118,935,122	146,623,210
Total, lode mines	[2] 116	[1] 3,139,286	16,011	8,142,262	3,096,000	136,894,000	166,926,000
Total, placers	27	----------	1,769	405	----------	----------	----------
	143	[1] 3,139,286	17,780	8,142,667	3,096,000	136,894,000	166,926,000
Total, 1944	132	[3] 3,271,038	25,008	9,931,614	3,376,000	167,060,000	182,744,000

[1] Includes 92,266 tons of lead-smelter slag.
[2] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[3] Includes 115,281 tons of lead-smelter slag.

METALLURGIC INDUSTRY

Of the 3,139,286 tons of ore produced in 1945 in Idaho, 3,027,500 tons (96 percent) were treated at concentration plants, 109,856 tons (3 percent) were shipped crude to smelters, and 1,930 tons (1 percent) were treated at amalgamation mills.

Concentration plants in 1945 treated 109,821 tons of gold ore, 10 tons of gold-silver ore, 117,692 tons of silver ore, 1,850 tons of copper ore, 103,381 tons of lead ore, 7,773 tons of zinc ore, and 2,686,973 tons of zinc-lead ore and old tailings. Current hot zinc slag totaling 60,805 tons was fumed, and 92,266 tons of old dump lead-smelter slag were delivered for smelting and fuming in 1945. The old dump slag was credited to the Bunker Hill smelter dump, and all the hot slag was credited to various producers of the ores and concentrates that contributed during the year to the slag-making material.

Ore treated at straight amalgamation mills in 1945 totaled 109 tons and that at combined amalgamation and concentration plants, 1,821 tons; none was treated at cyanidation plants.

The Bunker Hill & Sullivan Mining & Concentrating Co. operated its Bradley lead smelter and refinery at a lower rate than in 1944 on ore and concentrates, chiefly from mines and mills in the Coeur d'Alene region. The company also operated its antimony and bismuth plant, 1,700-ton flotation mill (including sink-and-float unit), 300-ton tailing-treatment plant for recovery of silver, iron, and lead from old jig tailings, and 450-ton zinc slag-fuming plant at Bradley; early in 1945 it began producing high-grade metallic cadmium from accumulated smelter residues at its new cadmium plant annex at the Bunker Hill smelter. The slag-fuming plant yielded 24,043 dry tons of deleaded zinc fume and 1,882 dry tons of lead fume; the production of lead and zinc in 1945 was slightly greater than in 1944. The Sullivan Mining Co. operated continuously at capacity its 100-ton electrolytic zinc plant near Bradley on zinc and zinc-lead concentrates produced mainly in the Coeur d'Alene region. During the year the Bunker Hill & Sullivan Mining & Concentrating Co., the Sullivan Mining Co., and the Office of Metals Reserve (successor to Metals Reserve Company July 1) stock-piled several thousand tons of zinc concentrates at Bradley. Antimony, tungsten, and antimony-iron-gold concentrates were produced 8 months of the year in the 800-ton flotation mill of the Bradley Mining Co. at Stibnite. During August, September, October, and November the company treated only old tungsten tailings. Some of the tungsten concentrates produced at the company mill at Stibnite were hauled to the company leaching plant at Boise, where muriatic acid was used to eliminate the apatite and calcite and caustic soda to eliminate the antimony from the concentrates; this additional treatment produced a 70-percent tungstic oxide concentrate. The antimony concentrate was shipped to the antimony plant of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley, Idaho, and the antimony-iron-gold concentrate to the lead smelter of the United States Smelting, Refining & Mining Co. at Midvale, Utah. Tungsten concentrates and silver-copper-lead-iron concentrates were produced throughout the year in the Ima mill at Patterson.

Mine production of metals in Idaho in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	1,930	373	203	----------	----------	----------
Concentrates smelted	270,309	14,136	8,000,639	2,661,723	131,781,728	148,778,579
Ore smelted	109,856	1,502	141,420	434,277	5,112,272	18,147,421
Placer	----------	1,769	405	----------	----------	----------
	----------	17,780	8,142,667	3,096,000	136,894,000	166,926,000
Total, 1944	----------	25,008	9,931,614	3,376,000	167,060,000	182,744,000

Mine production of metals from amalgamation mills (with or without concentration equipment) in Idaho in 1945, by counties, in terms of recovered metals

County	Material treated	Recovered in bullion		Concentrates smelted and recovered metal				
		Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Ada	10	5	----------	----------	----------	----------	----------	----------
Boise	84	114	48	----------	----------	----------	----------	----------
Elmore	1,822	240	150	27	98	3,747	----------	----------
Idaho	14	14	5	1	----------	71	----------	----------
	1,930	373	203	28	98	3,818	----------	----------
Total, 1944	43,625	2,429	1,230	321	1,991	14,467	----------	----------

Mine production of metals from concentrating mills in Idaho in 1945, by counties, in terms of recovered metals

County	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	105,959	23,913	6,230	511,558	249,888	5,058,705	6,557,320
Boise	25	1	10	6	----------	----------	----------
Bonner	3,848	265	2	39,721	1,600	206,000	23,800
Boundary	6,669	447	279	6,719	5,400	213,000	108,400
Butte	4,776	1,274	94	8,542	23,814	274,453	438,800
Custer	35,513	2,896	125	146,079	98,203	2,245,778	720,753
Lemhi	32,000	1,083	13	45,516	74,400	83,000	----------
Owyhee	7,523	2,280	58	41,054	93,600	48,000	1,355,600
Shoshone	2,697,004	231,559	1,895	7,065,752	2,034,218	123,001,292	138,047,906
Valley	134,183	6,563	5,332	131,874	80,600	651,500	1,526,000
	3,027,500	270,281	14,038	7,996,821	2,661,723	131,781,728	148,778,579
Total, 1944	[1] 3,140,182	338,782	18,901	9,815,184	3,136,937	162,894,337	168,209,683

[1] Includes 37,175 tons of hot lead-smelter slag fumed.

Gross metal content of concentrates produced from ores mined in Idaho in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	2,127	3,663	10,331			
Dry gold-silver	2,490	1,307	36,331			
Dry silver	1		71			
Copper	1,539	88	156,802	319,402	108,371	
Lead	87,612	2,312	4,693,258	1,374,846	107,577,649	13,319,525
Lead-copper	5,495	466	2,005,364	545,941	3,563,886	357,477
Zinc	122,640	1,253	524,374	529,466	7,703,957	128,299,323
Zinc-lead	34,228	685	473,294	139,102	15,070,128	13,996,268
Zinc-lead-copper	380	30	68,324	96,192	148,747	109,206
Dry iron (from zinc-lead ore and lead ore)	13,797	4,340	35,240	30,699	313,235	612,947
	270,309	14,144	8,003,389	3,035,648	134,485,973	156,694,746
Total, 1944	[1] 339,103	20,892	9,835,771	3,589,707	166,358,574	191,632,015

[1] Includes 139 tons of lead fume and 6,150 tons of zinc fume produced at a zinc slag-fuming plant.

Mine production of metals from Idaho concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Blaine	23,913	6,230	511,558	249,888	5,058,705	6,557,320
Boise	1	10	6			
Bonner	265	2	39,721	1,600	206,000	23,800
Boundary	447	279	6,719	5,400	213,000	108,400
Butte	1,274	94	8,542	23,814	274,453	438,800
Custer	2,896	125	146,079	98,203	2,245,778	720,753
Elmore	27	98	3,747			
Idaho	1		71			
Lemhi	1,083	13	45,516	74,400	83,000	
Owyhee	2,280	58	41,054	93,600	48,000	1,355,600
Shoshone	231,559	1,895	7,065,752	2,034,218	123,001,292	138,047,906
Valley	6,563	5,332	131,874	80,600	651,500	1,526,000
	270,309	14,136	8,000,639	2,661,723	131,781,728	148,778,579
Total, 1944	[1] 339,103	20,892	9,829,651	3,136,937	162,894,337	168,209,683

BY CLASSES OF CONCENTRATES

Dry gold	2,127	3,663	10,331			
Dry gold-silver	2,490	1,307	36,331			
Dry silver	1		71			
Copper	1,539	88	156,802	305,895	83,000	
Lead	87,612	2,312	4,693,258	1,163,136	105,774,465	10,472,720
Lead-copper	5,495	466	2,005,364	465,250	3,505,477	290,750
Zinc	122,640	1,245	521,624	497,277	7,305,063	124,827,852
Zinc-lead	34,228	685	473,294	120,432	14,761,734	13,105,257
Zinc-lead-copper	380	30	68,324	82,236	146,300	82,000
Dry iron (from zinc-lead ore and lead ore)	13,797	4,340	35,240	27,497	205,689	
	270,309	14,136	8,000,639	2,661,723	131,781,728	148,778,579

[1] Includes 139 tons of lead fume and 6,150 tons of zinc fume produced at a zinc slag-fuming plant.

Gross metal content of Idaho crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	1,279	621	735	3,305	3,648	----------
Dry and siliceous gold-silver	54	360	6,965	----------	1,560	----------
Dry and siliceous silver	4,402	----------	11,443	----------	377,207	----------
Copper	6,719	462	8,046	419,836	----------	----------
Lead	4,130	36	53,248	12,229	1,216,718	91,194
Lead-copper	67	1	11,142	6,274	25,268	1,650
Zinc	[1] 92,266	----------	33,248	----------	3,375,870	22,485,544
Zinc-lead	939	22	16,593	9,082	301,030	186,787
	[1] 109,856	1,502	141,420	450,726	5,301,301	22,765,175
Total, 1944	[2] 87,231	1,551	100,702	247,838	4,362,214	18,229,177

[1] Includes 92,266 tons of lead-smelter slag smelted and fumed.
[2] Includes 78,106 tons of lead-smelter slag smelted and fumed.

Mine production of metals from Idaho crude ore shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Adams	68	3	329	22,600	----------	----------
Blaine	1,502	321	3,647	4,712	70,295	680
Boise	91	205	1,590	----------	1,500	----------
Butte	584	3	1,358	586	183,047	----------
Clark	505	1	495	600	148,000	----------
Custer	8,809	605	71,091	371,797	573,722	70,247
Elmore	44	328	5,719	----------	----------	----------
Lemhi	1,047	30	7,297	32,200	277,000	65,400
Shoshone	[1] 97,204	1	49,894	1,782	3,858,708	18,011,094
Valley	2	5	----------	----------	----------	----------
	[1] 109,856	1,502	141,420	434,277	5,112,272	18,147,421
Total, 1944	[2] 87,231	1,551	100,702	239,063	4,165,663	14,534,317

BY CLASSES OF ORE

	Ore	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	1,279	621	735	3,165	2,036	----------
Dry and siliceous gold-silver	54	360	6,965	----------	1,500	----------
Dry and siliceous silver	4,402	----------	11,443	----------	362,000	----------
Copper	6,719	462	8,046	408,600	----------	----------
Lead	4,130	36	53,248	9,435	1,170,870	11,094
Lead-copper	67	1	11,142	5,357	24,996	1,196
Zinc	[1] 92,266	----------	33,248	----------	3,255,000	18,000,000
Zinc-lead	939	22	16,593	7,720	295,870	135,131
	[1] 109,856	1,502	141,420	434,277	5,112,272	18,147,421

[1] Includes 92,266 tons of lead-smelter slag smelted and fumed.
[2] Includes 78,106 tons of lead-smelter slag smelted and fumed.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Idaho in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing: Lode	Mines producing: Placer	Ore sold or treated	Gold: Lode	Gold: Placer	Gold: Total	Silver: Lode	Silver: Placer	Silver: Total	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Ada County: Black Hornet	1		10	5		5							$175
Adams County: Seven Devils	3		68	3		3	329		329	22,600			3,390
Blaine County:													
Lava Creek [1]	1		3,043	22		22	5,251		5,251	5,000	114,500	332,400	53,252
Little Wood River (Muldoon)	3		569	4		4	4,410		4,410	2,800	95,500	17,800	13,914
Mineral Hill and Camas	4		9,601	163		163	45,187		45,187	18,200	225,500	613,200	130,206
Warm Springs	4		94,248	6,362		6,362	460,357		460,357	228,600	4,693,500	5,594,600	1,627,916
Boise County:													
Boise Basin	5	6	122	223	1,635	1,858	1,599	391	1,990		1,500		66,574
Summit Flat	2		78	106		106	45		45				3,742
Bonner County:													
Clark Fork	1		3,055	1		1	36,914		36,914	1,200	189,000	13,400	44,242
Lakeview	1		600	1		1	2,686		2,686	200	6,000	3,400	2,879
Pend d'Oreille	1		193				121		121	200	11,000	7,000	1,864
Bonneville County: Mount Pisgah		1			35	35							1,225
Boundary County:													
Moyie Yahk	1		4,269	277		277	4,476		4,476	3,400	90,500	97,000	32,275
Port Hill	1		2,400	2		2	2,243		2,243	2,000	122,500	11,400	13,781
Butte County:													
Dome	1		1,485	4		4	1,440		1,440	600	223,000		20,423
Lava Creek [1]	3		3,875	93		93	8,460		8,460	23,800	234,500	438,800	83,113
Clark County: Birch Creek	1		505	1		1	495		495	600	148,000		13,196
Clearwater County:													
Clearwater River		1			17	17		7	7				600
Pierce		1			5	5							175
Custer County:													
Alder Creek	3		8,503	528		528	10,433		10,433	433,000	75,000		90,804
Bayhorse	6		35,309	67		67	200,631		200,631	35,600	2,604,500	708,600	455,298
Boulder	1		352	6		6	3,164		3,164	600	109,500	41,400	16,719
Seafoam	1		141	4		4	2,866		2,866	600	30,500	41,000	9,597
Yankee Fork	2		17	125		125	76		76	200			4,456
Elmore County: Middle Boise (Atlanta)	3		1,866	666		666	9,616		9,616				30,148
Idaho County:													
Burgdorf		1			14	14							490
Camp Howard		1			5	5							175
Elk City		1			2	2							70
Florence and French Creek		3			14	14		7	7				495

Newsome	-	1	-	-	6	6	-	-	-	-	-	-	210
Orogrande	-	1	-	-	5	5	-	-	-	-	-	-	175
Simpson	-	3	-	-	8	8	-	-	-	-	-	-	280
Warren	3	-	14	14	-	14	76	-	76	-	-	-	544
Jerome County: Snake River	-	1	-	-	1	1	-	-	-	-	-	-	35
Latah County: Moscow Mountains	-	1	-	-	4	4	-	-	-	-	-	-	140
Lemhi County:													
Blue Wing	1	-	32,000	13	-	13	45,516	-	45,516	74,400	83,000	-	50,004
Eureka	1	-	101	1	-	1	38	-	38	11,400	-	-	1,601
Junction	1	-	2	-	-	-	-	-	-	600	-	-	81
Mackinaw	1	-	70	2	-	2	59	-	59	16,000	-	-	2,272
Rattlesnake Creek	1	-	53	-	-	-	308	-	308	400	13,000	-	1,391
Salmon River	-	1	-	-	8	8	-	-	-	-	-	-	280
Texas	3	-	779	27	-	27	6,781	-	6,781	3,800	252,000	65,400	35,473
Unorganized (Reno)	1	-	42	-	-	-	111	-	111	-	12,000	-	1,111
Owyhee County:													
Snake River	-	2	-	-	2	2	-	-	-	-	-	-	70
South Mountain	1	-	7,523	58	-	58	41,054	-	41,054	93,600	48,000	1,355,600	203,882
Shoshone County:													
Beaver	3	1	112,607	208	2	210	112,289	-	112,289	102,400	5,567,000	13,539,400	2,136,817
Eagle	1	-	4,324	18	-	18	7,259	-	7,259	9,600	581,500	19,400	59,328
Evolution	7	-	1,069,272	264	-	264	4,348,717	-	4,348,717	1,208,200	20,051,500	21,407,600	7,451,071
Hunter	6	-	450,343	241	-	241	581,047	-	581,047	151,600	27,240,500	39,405,200	7,316,371
Lelande	9	-	155,802	142	-	142	383,476	-	383,476	92,600	11,684,500	11,092,800	2,570,704
Placer Center	8	-	149,112	139	-	139	196,806	-	196,806	74,200	8,919,000	10,594,000	2,140,177
Summit	1	-	315	3	-	3	225	-	225	400	40,500	30,000	7,252
Yreka	14	-	852,433	881	-	881	1,485,827	-	1,485,827	397,000	52,775,500	59,970,600	12,576,330
Valley County:													
Deadwood Basin	1	-	24,377	470	-	470	88,965	-	88,965	80,600	651,500	1,526,000	322,114
South Fork of Salmon River	1	1	1	2	6	8	-	-	-	-	-	-	280
Thunder Mountain	1	-	1	3	-	3	-	-	-	-	-	-	105
Yellow Pine	2	-	109,806	4,862	-	4,862	42,909	-	42,909	-	-	-	200,683
	116	27	3,139,286	16,011	1,769	17,780	8,142,262	405	8,142,667	3,096,000	136,894,000	166,926,000	37,799,975

[1] Lava Creek district lies in both Blaine and Butte Counties.

ADAMS COUNTY

All of the output in Adams County in 1945 was carbonate copper ore (68 tons) shipped to a smelter from the Arkansaw-Decorah, Lockwood, and South Peacock properties, which are near Cuprum in the Seven Devils district.

BLAINE COUNTY

Lava Creek district.—Hoyt Ray continued operating the Paymaster mine, 32 miles southwest of Arco, and shipped 3,043 tons of zinc-lead-iron ore to a custom flotation mill at Midvale, Utah, where it was separated into a lead concentrate, a zinc concentrate, and an iron concentrate.

Little Wood River (Muldoon) district.—The Eagle Bird Lease continued working the Eagle Bird mine in Garfield Canyon and shipped 276 tons of oxide silver-lead ore and 94 tons of zinc-lead ore to treatment plants in Utah. The rest of the district output was 198 tons of zinc-lead ore produced from the Idaho Muldoon mine and 1 ton of similar ore from the Black Rock claim.

Mineral Hill and Camas district.—Except for gold, the metal output of the Mineral Hill district increased considerably in 1945, owing to the large gain in output of zinc-lead ore from the Snoose mine near Hailey and to the increase in shipments of old tailings, containing principally silver, lead, and zinc, from the Red Elephant dump. Jensen & Stevens operated the Snoose mine throughout the year and shipped 3,166 tons of ore, containing an average of 0.04 ounce of gold and 3.91 ounces of silver to the ton, 0.22 percent copper, 2.04 percent lead, and 4.70 percent zinc, to custom milling plants in Utah. Old tailings (6,433 tons) from the Red Elephant dump were shipped to the custom flotation mill at Midvale by Frank R. Plughoff.

Warm Springs district.—Despite a decrease of 16 percent in the output of zinc-lead-silver ore from the Triumph-North Star-Independence groups near Ketchum in 1945 compared with 1944, the property remained the most important producer of gold, silver, lead, and zinc in southern Idaho. The Triumph Mining Co. operated the groups throughout 1945 and treated 61,695 tons of low-grade zinc-lead-silver ore in its 300-ton gravity-flotation mill, recovering lead-silver concentrates and zinc-lead middlings. The middling (17,722 tons) and 30,372 tons of higher-grade zinc-lead-silver ore were shipped to Bauer, Utah, for treatment, and the lead-silver concentrate (1,593 tons) was shipped direct to a lead smelter. The rest of the district output comprised 1,179 tons of siliceous gold ore shipped direct to a smelter from the June Day mine, 752 tons of zinc-lead ore produced from the Homestake mine, and 250 tons of zinc ore from the Lucky Boy mine.

BOISE COUNTY

Boise Basin district (Centerville, Placerville, Idaho City, Pioneerville, Quartzburg).—The Boise Basin district became an important producer of gold again in 1945, resulting from the rescinding by the Government of L–208. In September the Idaho-Canadian Dredging Co., a large producer of gold in 1942, resumed operating its 7½-cubic foot bucket dredge at property near Idaho City; during the last 3½ months of the year the dredge treated 250,000 cubic yards of gravel, which yielded 1,593 fine ounces of gold and 377 fine ounces of silver. Other producers of placer gold included the Fountain Spring, Moe, and Ophir Creek properties. Gold produced from lode mines in the district totaled 223 fine ounces, which came largely from old mill cleanings from the Gold Hill & Iowa property and from crude ore shipped direct to a smelter from the Come-Back mine.

Summit Flat district.—A total of 78 tons of rich gold ore was produced in 1945 from two mines—Jessie and Rock Creek—and treated by amalgamation.

BONNER COUNTY

Clark Fork district.—In 1945 the Whitedelf mine was the only producer in the Clark Fork district. The property was worked throughout the year by the Whitedelf Mining & Development Co., and 3,055 tons of ore containing 40,000 ounces of silver, 211,800 pounds of lead, and a little copper and zinc were treated in the company 50-ton flotation mill.

Lakeview district.—The Hewer (Idaho-Lakeview) mine was worked throughout the year principally on development; however, 600 tons of silver ore, containing a little copper, lead, and zinc, were treated by flotation.

Pend d'Oreille district.—Approximately 193 tons of zinc-lead ore were produced from the Gold Coin mine in 1945 and treated by flotation; a new organization—Gold Coin Mining & Milling Co., Inc.—operated the mine continuously.

BONNEVILLE COUNTY

The Lottie placer near Gray in the Mount Pisgah district was operated a few months in 1945, and 35 fine ounces of gold were recovered from bench gravel by hydraulicking and sluicing.

BOUNDARY COUNTY

Moyie Yahk district.—The Regal mine, 14 miles northeast of Bonners Ferry, was operated throughout the year by Silver Crescent, Inc. The company reported that 4,269 tons of sulfide ore containing 300 ounces of gold, 5,500 ounces of silver, 5,000 pounds of copper, 120,000 pounds of lead, and 170,000 pounds of zinc were treated by flotation; zinc-lead concentrate (243 tons) and zinc concentrate (80 tons) were shipped to reduction plants at Bradley, Idaho.

Port Hill district.—In 1945, 2,400 tons of lead ore were produced from the Idaho-Continental mine and treated by flotation, which yielded 124 tons of silver-lead concentrates.

BUTTE COUNTY

Dome district.—William H. Gibson operated the Wilbert mine and tailing dump under lease in 1945; he shipped 555 tons of crude lead ore direct to a smelter and treated 930 tons of old tailings (containing chiefly lead) by flotation.

Lava Creek district.—Zinc-lead-iron ore was mined throughout the year at the Horn Silver mine, 20 miles southwest of Arco, by the Era Mining & Development Co., Inc.; a total of 3,840 tons of sulfide ore, containing 100 ounces of gold, 9,079 ounces of silver, 35,967 pounds of copper, 248,824 pounds of lead, 588,828 pounds of zinc, and some iron, was shipped to custom flotation mills in Utah, where it was separated into lead concentrate, zinc concentrate, and iron concentrate. The rest of the district output was 35 tons of lead ore produced from the Eureka and Zinc-Clarke properties.

CLARK COUNTY

The only output in Clark County in 1945, as in 1944, was lead ore produced from the Scott mine on Birch Creek. The Birch Creek Mining Co., Ltd., operated the mine continuously and shipped 505 tons of oxide lead ore to a smelter in Utah.

CLEARWATER COUNTY

Clearwater River district.—Approximately 17 fine ounces of gold and 7 fine ounces of silver were recovered in 1945 by hydraulicking and sluicing at the Clearwater Placers.

CUSTER COUNTY

Alder Creek district.—The output of gold, silver, and copper in the Alder Creek district was much greater in 1945 than in 1944, owing to a larger production of copper ore from the Empire mine near Mackay. The Mackay Exploration Co. worked the mine and 100-ton mill, shipped 6,478 tons of ore (containing 456 ounces of gold, 7,620 ounces of silver, and 367,893 pounds of copper) to a smelter in Utah, and treated 1,850 tons of similar ore by flotation. The remainder of the district output was 175 tons of silver-lead ore produced from the Horseshoe and Homestake properties.

Bayhorse district.—In 1945 six mines in the Bayhorse district produced a total of 35,309 tons of ore, compared with 48,830 tons in 1944. As usual, the most important output was zinc-lead ore from the Clayton mine operated by Clayton Silver Mines, but the output of ore from this mine declined from 39,258 tons in 1944 to 29,127 tons in 1945. All the ore was treated in the company 120-ton concentrator, which yielded 1,495 tons of high-grade lead-silver concentrate and 605 tons of zinc concentrate. Swigert Mines operated the Pacific claim of the Salmon River group near Challis throughout the year, treated 3,780 tons of oxide lead-silver ore by gravity concentration, and shipped 552 tons of zinc-lead-silver ore to a smelter in Utah. The rest of the district output comprised 1,436 tons of oxide lead-silver ore produced from the Red Bird mine by the Monongahela-Mt. Washington Mining Co., 302 tons of similar ore from the South Butte mine, 67 tons of high-grade silver-lead-copper ore from the Ramshorn mine, and 45 tons of lead-silver ore from the Turtle claim.

Boulder district.—Lessees worked the Livingston mine near Clayton in 1945 and shipped 313 tons of zinc-lead ore to a custom mill in Utah and 39 tons of lead-silver ore to a smelter.

Seafoam district.—The Shirts & Larson Lease operated the Mountain King mine northwest of Stanley a few months in 1945 and shipped 141 tons of zinc-lead-silver ore to Midvale, Utah, for treatment.

Yankee Fork district.—All the output of the Yankee Fork district in 1945 was high-grade gold ore (17 tons), produced from the Fourth of July and Snowdrift claims near Sunbeam.

ELMORE COUNTY

Middle Boise (Atlanta) district.—The value of the metal output of the Middle Boise district dropped from $175,129 in 1944 to $30,148 in 1945, as a consequence of treating a smaller quantity of gold ore than in 1944 from the Boise-Rochester-Monarch property of the Talache Mines, Inc. The company reported that work during 1945 was devoted principally to maintenance and repair and that the 400-ton amalgamation and concentration mill ran only intermittently, treating 1,815 tons of gold ore compared with 43,541 tons in 1944. In addition, 37 tons of high-grade gold ore were shipped to a smelter. The remainder of the district output was 14 tons of gold ore produced from the Golden Stringer and Lucky Strike claims at Atlanta.

IDAHO COUNTY

Most of the mining districts in Idaho County are gold-producing areas (placer and lode), but despite rescission of WPB Order L-208 on July 1, 1945, no revival at gold properties in any districts in Idaho County was noticeable during the year. Most of the output in 1945 was 54 ounces of placer gold recovered from claims in the Burgdorf, Camp Howard (Salmon River), Elk City, Florence and French Creek, Newsome, Orogrande, and Simpson (Salmon River) districts. A little (14 ounces) lode gold was recovered from gold ore from three claims—King Fish, Little Giant, and Smith—in the Warren district.

LEMHI COUNTY

Blue Wing district.—The Ima mine at Patterson, owned by the Ima Mines Corp. and a producer of silver, lead, copper, and tungsten for the past 27 years, was taken over under lease and option to purchase January 5, 1945, by the Bradley Mining Co. The latter company worked the mine and 150-ton concentration plant continuously in 1945; about 32,000 tons of ore containing hübnerite, galena, tetrahedrite, and pyrite were treated in the mill. Tungsten was recovered by gravity and flotation concentration, followed by magnetic separation, and silver, copper, and lead were recovered by bulk sulfide flotation. Lead-copper-silver concentrate (1,083 tons) was shipped to a smelter in Utah, and tungsten concentrates were sent to an eastern market.

Eureka district.—Lessees worked the Pope-Shenon (Grandview) mine near Salmon a short time in 1945 and shipped 101 tons of copper ore to a smelter in Utah.

Mackinaw district.—Roy Jackson operated the Copper King mine, 8 miles south of Shoup, nearly all of 1945 and shipped 70 tons of copper ore to a smelter in Montana.

Rattlesnake Creek district.—Twin Peaks Mine, Inc., did considerable work in 1945 at the Twin Peaks mine south of Salmon. The company erected a 1,000-foot aerial tramway, a 30-ton flotation mill, and surface buildings; rebuilt roads; did 502 feet of development; and shipped 53 tons of lead ore to a smelter.

Texas district.—The output of the Texas district in 1945 comprised 719 tons of oxide zinc-lead-silver ore produced from the Latest Out mine near Gilmore, 53 tons of lead-silver ore from the Alex Stevens mine, and 7 tons of lead ore from the Hutchings claim.

Unorganized (Reno) district.—Frank G. Worthing worked his Cabin mine throughout the year and shipped 42 tons of oxide lead ore to a smelter in Utah.

OWYHEE COUNTY

South Mountain district.—The South Mountain Mining Co. operated the Golconda mine until December 22, when operations were abandoned permanently. During the year the company shipped 7,523 tons of ore, containing 82 ounces of gold, 48,152 ounces of silver, 115,848 pounds of copper, 61,650 pounds of lead, 1,718,384 pounds of zinc, and some iron to the International flotation mill at Tooele, Utah, where it was separated into zinc-lead-copper-silver concentrate, zinc concentrate, and iron concentrate.

SHOSHONE COUNTY

COEUR d'ALENE REGION

In 1945 the Coeur d'Alene region, Shoshone County, remained the largest silver-producing area in the United States, ranked second in lead, and was third in zinc; it produced 87 percent of Idaho's silver, 66 percent of the copper, 93 percent of the lead, and 93 percent of the zinc. The value of the metal output of the region was $34,258,050 (91 percent of the State value) compared with $38,307,297 in 1944. The output of each metal decreased; gold declined 9 percent, silver 18 percent, copper 21 percent, lead 17 percent, and zinc 8 percent. The chief producers of zinc in the region in 1945, according to rank (each producing more than 8,000,000 pounds), were the Star, Osburn tailing plant, Bunker Hill smelter-slag dump, Morning, Page, Tamarack, and Monitor properties; the chief producers of lead, according to rank (each producing more than 6,000,000 pounds), were the Bunker Hill & Sullivan, Osburn tailing plant, Morning, Star, Page, Sweeny tailing dump, and Sherman properties; and the chief producers of silver, according to rank (each producing more than 250,000 ounces), were the Sunshine, Polaris, Osburn tailing plant, Bunker Hill & Sullivan, Silver Dollar, Page, and Morning properties.

Of the total material (2,794,208 tons) produced in 1945 in the Coeur d'Alene region, 90 percent was zinc-lead ore and old tailings, 3 percent lead-silver ore, 3 percent zinc slag, and the remainder silver ore.

Mine production of gold, silver, copper, lead, and zinc in the Coeur d'Alene region, Shoshone County, 1944–45, and total 1884–1945, in terms of recovered metals

Year	Mines producing		Ore	Gold (lode and placer)	Silver (lode and placer)	Copper	Lead	Zinc	Total value
	Lode	Placer							
			Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
1944	47	1	2,765,483	2,075	8,669,371	2,578,000	153,625,000	170,454,000	$38,307,297
1945	49	1	2,794,208	1,898	7,115,646	2,036,000	126,860,000	156,059,000	34,258,050
Total, 1884–1945			(1)	391,308	426,631,752	[2] 64,554	[2] 5,475,519	[2] 1,129,437	1,089,251,651

[1] Figures not available.
[2] Short tons.

Beaver district.—The output of the Beaver district in 1945 was 112,607 tons of zinc-lead ore compared with 101,180 tons of zinc-lead ore and 6,600 tons of zinc ore in 1944. The most important output was 77,555 tons of ore, averaging 0.97 ounce of silver to the ton, 2.49 percent lead, and 5.44 percent zinc, from the Amazon-Carlisle-Portland groups (Monitor Mining Co.) treated in the Hercules, Dayrock, and Carlisle flotation mills near Wallace. According to the printed annual report of the Monitor Mining Co., the output of ore in 1945 increased slightly over that in 1944; however, labor shortages prevented the expansion of production that had been expected a year earlier. Since rehabilitation of the Monitor properties was seriously undertaken in the autumn of 1942, the company has reopened and partly explored several different vein systems with success; however, much work remains to be done. The present ceiling prices of silver, lead, and zinc do not promise profitable operations despite substantial tonnages of developed low-grade ore. In August 1945 the Monitor Mining Co. purchased the old Interstate group from the Callahan Zinc-Lead Co. The group consisted of 79 patented and 4 unpatented claims contiguous to the east and south of the Monitor holdings. As rapidly as conditions permit, the lower part of the Interstate mine, under water for more than 20 years, will be pumped out and connected to the Carlisle mill level by approximately 1,800 feet of drifting. The Monitor management believes that substantial tonnages of ore equal in grade to that being mined at the Amazon mine remain in the Interstate mine.

Sunset Lease worked the Sunset mine continuously and hauled 24,982 tons of ore, averaging 2.14 ounces of silver to the ton, 4.45 percent lead, and 8.19 percent zinc, to the Golconda custom flotation mill near Wallace. The rest of the district lode output was 10,070 tons of zinc-lead ore produced from the Nipsic claim of the Interstate-Callahan group by the Daylight Lease.

Eagle district.—The Crystal Lead Lease operated the Crystal Lead group near Murray in 1945 and hauled 4,288 tons of lead ore to the Galena (Zanetti) custom mill near Wallace. In addition, 36 tons of high-grade lead ore were shipped to a smelter.

Evolution district.—The output of the Evolution district in 1945 comprised 981,330 tons of zinc-lead old tailings, 75,487 tons of lead-silver ore, and 12,455 tons of silver-copper-antimony ore, compared with 724,121 tons of zinc-lead old tailings, 64,515 tons of lead-silver ore, 40,674 tons of silver ore, and 28,635 tons of silver-copper-antimony ore in 1944. Most of the old tailings in 1945 came from the Osburn dump, all the lead-silver ore from the Chester vein and the Silver Syndicate fault zone, and all the silver-copper-antimony ore from the Mineral Point mine. The 2,500-ton sink-and-float plant and 500-ton flotation mill at the Osburn tailing dump were operated at capacity throughout the year by the Hecla Mining Co. The company reported that 974,433 tons of old tailings, containing an average of 1.22 ounces of silver to the ton, 1.41 percent lead, 1.69 percent zinc, and a little copper, were treated during the year in the sink-and-float plant; the resulting zinc-lead middling (617,186 tons) was treated in the Osburn, Polaris, Hecla, and Silver Crescent flotation mills, where it was separated into 10,533 tons of lead concentrates and 18,956 tons of zinc concentrates. The property ranked second in lead and zinc production in Idaho in 1945 and third in silver. The Sunshine Mining Co. operated the Chester vein and the Silver Syndicate fault zone until December 17, when all production ceased owing to a fire that broke out in a locomotive-battery charging station on the 2,900 level. The original fire was extinguished, but a secondary fire, possibly due to spontaneous combustion induced by heat from the first, broke out in drift and stope timber some 300 to 400 feet east of the original fire. By January 30, 1946, the fire was put out and mining resumed; however, it will take several months before operations can be fully restored. The Chester vein and Silver Syndicate fault zone (known as Rambo, Omega, and Rotbart areas) includes property owned by the Sunshine Mining Co., Polaris Mining Co., Silver Dollar Mining Co., and Silver Syndicate, Inc., but all exploration, development, and mining and milling of ore are done by the Sunshine Mining Co. The Sunshine Mining Co. reported that the total output of ore in 1945 was 75,179 tons (32,312 tons for Sunshine account and 42,867 tons for account of Polaris, Silver Dollar, and Silver Syndicate) compared with 91,956 tons in 1944; the ore averaged 47.42 ounces of silver to the ton, 0.44 percent copper, 4.58 percent lead, and a little zinc. The tailings averaged 0.77 ounce of silver to the ton and 0.15 percent lead; lead recovery was 97.2 percent and silver 98.6 percent. Lead-silver concentrates (9,845 tons) contained 3,514,178 ounces of silver, 843,000 pounds of copper, and 6,703,810 pounds of lead, of which the net for Sunshine account was 1,467,070 ounces of silver, 347,853 pounds of copper, and 2,953,949 pounds of lead. Production credited to other companies (Polaris, Silver Dollar, and Silver Syndicate) was 2,047,108 ounces of silver, 495,148 pounds of copper, and 3,749,861 pounds of lead. According to the annual report of the Sunshine Mining Co., the labor shortage in 1945 was more acute than at any time during the war, and this with a 200-percent labor turn-over was responsible for a 21-percent decrease in tons of ore mined and a 38-percent decrease in development footage compared with 1944. Development in all areas in 1945 comprised 2,018 feet of drifting, 1,137 feet of raising, and 682 feet of crosscutting; and diamond drilling of 7 test holes totaled 1,926 feet. The most important development during the year was the discovery of lead-silver ore in the Silver Syndicate fault zone on the 3,700 level in territory in which Sunshine Mining Co. and Silver Syndicate, Inc., have equal interests. The ore varied in width from a few inches up to 12 feet for 169 feet in length. The average width for this length was 4.2 feet, and the average assays of the samples of ore cut were 47 ounces of silver to the ton and 22 percent lead. This discovery opens extensive exploration possibilities because of its great distance from any previously known ore occurrences. Exploration and development of the Chester vein in 1945 indicated a continuous ore shoot for a length of 950 feet on the 3,700 level, including 388 feet in the Omega area and 562 feet in the Rotbart area. The average width of the ore was 4 feet and the average silver assay 64 ounces per ton; the lead content was extremely low, being less than 0.5 percent. Developed ore reserves were increased during the year and are estimated at 987,000 tons, of which 544,000 tons are in areas where other companies participate in the production.

Output of silver-copper-antimony ore at the Mineral Point mine of the Coeur d'Alene Mines Corp. dropped from 25,337 tons in 1944 to 12,455 tons in 1945, and the company 600-ton flotation mill operated intermittently. Copper concentrate (291 tons) containing 110,364 ounces of silver, 161,653 pounds of copper, and 95,556 pounds of antimony was shipped to the copper smelter at Tacoma, Wash. According to the corporation printed annual report, the large decrease in output of ore in 1945 was due to the low grade of the ore, plus the fact that less than one-third of the underground crew could be employed breaking ore, the others being needed for development and maintenance. Ore containing an average of 9.04 ounces of silver to the ton, 0.67 percent copper, and 0.39 percent antimony was mined in 1945 from the 1,600, 1,800, 2,000, and 2,200 levels. The known ore bodies on the 1,600 and 1,800 levels are nearly exhausted, and future production will rely on ore below the 1,800 level. During the year considerable drifting was done on the 2,200 level, but despite good silver assays the vein was too narrow to provide commercial ore. The ore reserve on December 31, 1945, was estimated at 73,310 tons, with an average silver content of 10 ounces per ton. All this is marginal ore and can be mined at a profit only by handling a large tonnage under ideal conditions. The rest of the district output was 6,897 tons of old zinc-lead tailings from dumps near Osburn, treated in the Golconda custom mill.

Hunter district (Mullan).—A total of 450,343 tons of ore and old tailings was produced in 1945 from six properties in the Hunter district, compared with 528,015 tons of ore from six properties in 1944; the most important output was 395,838 tons of zinc-lead ore from the Morning and Star mines. Mining and milling operations at the Morning property of the Federal Mining & Smelting Co. were continuous throughout the year. The 1,250-ton mill treated 173,864 tons of waste-dump ore, containing an average of 0.7 ounce of silver to the ton, 1.2 percent lead, and 1.0 percent zinc; and 76,447 tons of mine ore, containing an average of 2.3 ounces of silver to the ton, 6.7 percent lead, and 8.6 percent zinc. The average mill recoveries in lead concentrate were silver 76.4 percent, lead 87.4 percent, and zinc 10.4 percent; in zinc concentrate, silver 13.2 percent, lead 3.9

percent, and zinc 81.4 percent. According to the printed annual report of the company for 1945, operations were on a 6-day work week throughout the year, and owing to the labor shortage the mine operated only one shift a day. Some additional labor began to come into the district in November and thereafter; the crew on January 1, 1946, was still about 235 men below normal. No shaft sinking was done in 1945; however, the shaft station and ore pockets on the 4,850 level were completed, and the crosscut was driven to intersect the vein which showed ore 3½ feet in width and of good grade. Ore reserves at the end of the year, including developed and probable ore in both the Morning and You-Like portions of the mine, are estimated at 582,500 tons, an increase of 52,500 tons over the estimated tonnage at the end of 1944.

The 1,000-ton flotation mill of the Sullivan Mining Co. at the Star mine operated continuously in 1945 on a basis of 6 days a week, three shifts per day, but only at 50-percent capacity owing to a shortage of miners in the Star mine. The mill treated 145,527 tons of zinc-lead ore (195,562 tons in 1944) from the Star mine, yielding 7,390 tons of lead concentrate and 23,646 tons of zinc concentrate, which contained 130 ounces of gold, 179,069 ounces of silver, 12,387,809 pounds of lead, and 24,964,866 pounds of zinc. The mine continued as the largest producer of zinc in Idaho. Hunter Lease operated the Gold Hunter mine and 500-ton flotation mill at Mullan throughout the year; 35,173 tons of ore and 4,416 tons of old tailings averaging 2.61 ounces of silver to the ton, 2.41 percent lead, and 0.75 percent zinc were treated in 1945, which yielded 1,315 tons of lead concentrate and 81 tons of zinc concentrate. The remainder of the district output comprised 6,016 tons of old zinc-lead tailings from the Mary D. property treated in the Golconda custom mill, 6,000 tons of waste-dump ore (containing chiefly silver and lead) from the Simia dump, and 2,900 tons of zinc-lead-silver ore from the Lucky Friday mine treated in the Golconda mill.

Lelande district (*Burke, Mace, Frisco*).—The output of the Lelande district was 152,512 tons of zinc-lead-silver ore and old tailings and 3,290 tons of lead ore in 1945 compared with 136,180 tons of zinc-lead-silver ore and old tailings and 31,748 tons of lead ore in 1944. Most of the output in 1945 was 77,490 tons of zinc-lead-silver ore from the Frisco and Sherman mines and 67,600 tons of old zinc-lead tailings from the Canyon Creek property above Wallace. The Federal Mining & Smelting Co. worked the lower levels of the Frisco mine at Gem throughout the year and hauled 27,909 tons of ore (containing an average of 1.28 ounces of silver to the ton, 3.60 percent lead, and 5.81 percent zinc) to the Morning mill at Mullan; Hull Lease continued working the upper levels and, in its own 90-ton flotation mill at Gem, treated 22,954 tons of similar ore, which yielded 1,530 tons of lead concentrate and 3,155 tons of zinc concentrate. According to the printed annual report of the Federal Mining & Smelting Co., operations at the Frisco mine were on a basis of 6 days per week throughout the year. The water level in the shaft was held 25 feet below the 1,200 level, but because of the labor shortage only a small amount of development was done. Ore reserves at the end of the year were estimated at 205,000 tons of developed and probable ore. From present indications, additional ores will be developed as the lower levels are made accessible.

Approximately 26,627 tons of zinc-lead-silver ore were produced in 1945 from the Sherman mine by the Sherman Lead Co. and treated in the company 300-ton flotation mill, which yielded 5,350 tons of zinc-lead-silver concentrate. The ore contained an average of 9.11 ounces of silver to the ton, 12.26 percent lead, and 2.00 percent zinc. According to the printed annual report of the company, very little development has been done in the mine during the war period. In 1945 development comprised 631 feet of drifting, 10 feet of crosscutting, and 139 feet of raising; diamond drilling aggregated 714 feet. Development was confined to the 1,500 level, which disclosed a medium-size, fair to low-grade ore shoot. The Sherman mine and mill are in excellent condition, and production can be increased whenever circumstances warrant. Factors affecting full resumption of operations are availability of labor, wage rates, and prices of silver and lead.

Small Leasing Co. operated its 140-ton flotation mill continuously in 1945 on old tailings (containing an average of 1.9 ounces of silver to the ton, 2.2 percent lead, and 2.8 percent zinc) deposited along Canyon Creek 3 miles above Wallace; 56,196 tons were treated in its own mill and 11,404 tons hauled to the Golconda custom mill. The rest of the district output was principally 7,292 tons of old zinc-lead tailings from property along Canyon Creek and 3,290 tons of lead ore produced by lessees from the Black Bear, Hecla, and Hercules mines.

Placer Center district.—The output of ore and old tailings in the Placer Center district dropped from 185,581 tons in 1944 to 149,112 tons in 1945, owing chiefly to a decline in output of zinc-lead-silver ore from the Tamarack mine; nevertheless, the mine remained the most important producer of ore in the district. The Tamarack & Custer Consolidated Mining Co. reported that 66,082 tons of ore (containing an average of 1.1 ounces of silver to the ton, 3.7 percent lead, and 6.6 percent zinc) were produced from the mine in 1945 (94,527 tons in 1944) and treated in its 400-ton flotation mill. In addition, lessees hauled 4,443 tons of dump ore and 276 tons of underground ore to the Galena (Zanetti) custom mill. According to the printed annual report of the company, the decline in output of ore from the Tamarack mine in 1945 was due entirely to lack of manpower. A crew of about 200 men is required at Tamarack No. 7 to maintain normal operations. At the beginning of the year, only 115 men were working and at the end of the year, 137. Some development was done in 1945 on all levels of the mine, except the 1,350, from the 1,000 down to the 2,000; no significant disclosures of ore were made. The 2,400 level, the lowest in the mine, will be explored in 1946, and the success of this work will have an important bearing upon the mine's future. The mine and mill are in good condition and ready for maximum production whenever additional manpower is available. Exploration has lagged in recent years, but the mine will undergo extensive development as soon as labor is available. Ore reserves have declined during the war period, both in quantity and quality.

The Dayrock Mining Co. operated its mine and 200-ton flotation mill continuously in 1945; a total of 30,922 tons of ore averaging 3.07 ounces of silver to the ton, 4.16 percent lead, and 0.40 percent zinc was treated in the Dayrock and Hercules milling plants and

717372—47——25

yielded 1,868 tons of high-grade silver-lead concentrate. In addition to Dayrock ore, the Dayrock mill treated 8,779 tons of custom ores. According to the company printed annual report, work at the mine in 1945 included deepening the shaft from the 500 to the 800 level. Other development comprised 1,561 feet of drifting, 350 feet of cross-cutting, and 739 feet of raising; diamond drilling aggregated 985 feet. Ore developed during the year was approximately equal to the tonnage extracted. Reserves developed during the year included ore on the 300 and 400 levels. A 150-horsepower hoist was installed on the main haulage level, which will permit efficient hoisting from the new lower levels.

About 25,300 tons of zinc-lead ore were produced in 1945 from the Red Monarch, Rex, and Delaware groups near Wallace by the Callahan Consolidated Mines Co. and treated in the company 100-ton flotation mill; the ore averaged 0.80 ounce of silver to the ton, 2.48 percent lead, and 2.59 percent zinc. The remainder of the district output was principally 20,742 tons of zinc-lead old tailings from the Rose, Tomsche, and Zanetti properties and 1,319 tons of zinc-lead ore produced by lessees from the Success mine—all treated in custom flotation mills near Wallace.

Summit district (*Murray*).—The Dan Murphy Leasing Co. worked the Orofino mine in 1945 and shipped 315 tons of zinc-lead ore to the Hercules custom mill near Wallace.

Yreka district (*Kellogg*).—The Yreka is the chief lead- and zinc-producing district in Idaho and ranks second in silver. In 1945 material treated in the district included 700,933 tons of zinc-lead-silver ore and old tailings, 92,266 tons of zinc slag, 48,383 tons of zinc-lead-iron-silver old tailings, and 10,851 tons of silver-lead ore—a total of 852,433 tons compared with a total of 917,240 tons in 1944. Despite a decrease of more than 100,000 tons of zinc-lead-silver ore from the Bunker Hill & Sullivan mine at Kellogg in 1945, it remained the most important producer of ore in the district. The company's main 1,700-ton flotation mill, equipped with a sink-and-float unit, operated continuously and treated 150,947 tons of zinc-lead-silver ore from the Bunker Hill & Sullivan mine and 312,719 tons of zinc-lead old tailings from the Sweeny dump. The ore contained an average of 4.87 ounces of silver to the ton, 7.25 percent lead, and 2.77 percent zinc and the old tailings, 0.83 ounce of silver to the ton, 1.62 percent lead, and 0.81 percent zinc. The mill yielded a total of 22,423 tons of lead concentrate and 5,952 tons of zinc concentrate, which were shipped to the lead- and zinc-reduction plants at Bradley. John George continued leasing operations in the upper levels of the Bunker Hill & Sullivan mine and treated about 6,000 tons of silver-lead ore in his mill. In addition, 449 tons of silver-lead ore were shipped direct to a smelter. The Bunker Hill & Sullivan Mining & Concentrating Co. also operated its 300-ton gravity-flotation plant from April 4 to November 17; treated 48,383 tons of old jig tailings containing an average of 1.19 ounces of silver to the ton, 2.29 percent lead, 1.29 percent zinc, and 15.74 percent iron; and shipped 92,266 tons of old Bunker Hill smelter slag (containing an average of 0.36 ounce of silver to the ton, 1.83 percent lead, and 12.18 percent zinc) to its lead smelter at Bradley. The resulting hot slag was sent to the slag-fuming plant, also at Bradley, to recover the zinc. According to the company printed annual report, there were produced and recovered from Bunker Hill & Sullivan mine ore (including lessee ore) 678,154 ounces of silver, 21,624,000 pounds of lead, and 7,124,000 pounds of zinc. Because of a continued shortage in manpower, especially for underground mine labor, metals recovered in 1945 decreased substantially compared with 1944. Although a relatively small amount of development and prospecting was done in 1945, ore reserves are large but decreased owing entirely to lack of competent underground mine labor. Ore reserves January 1, 1946, undercut and available for mining, totaled 2,631,835 tons of zinc-lead-silver ore. Operations at the zinc slag-fuming plant of the Bunker Hill & Sullivan Mining & Concentrating Co. at Bradley were carried on throughout the year at a slightly greater rate than in 1944. In 1945 the plant received 92,266 tons of old, reclaimed dump slag and 60,805 tons of hot current slag from the lead furnaces of the Bunker Hill smelter at Bradley; the resulting lead fume (1,882 tons) was sent to the Bunker Hill lead smelter, and the zinc fume (24,043 tons) was shipped to the smelters in the East. All of the lead and zinc produced at the plant in 1945 was credited to the mines furnishing the slag-making material.

Mining and milling of zinc-lead-silver ore from the Page mine (no ore was produced from the Blackhawk mine in 1945) by the Federal Mining & Smelting Co. were continuous in 1945 but at a lower rate than in 1944; 80,727 tons of ore were treated in 1945 compared with 116,976 tons in 1944. The ore, treated in the Page 500-ton flotation mill, contained an average of 4.22 ounces of silver to the ton, 7.21 percent lead, and 8.18 percent zinc. According to the printed annual report of the company, no shaft sinking was done in 1945 and very little development because of the shortage of labor; on the 1,800 level the drift on the Tony vein was driven 115 feet eastward. Ore reserves at the end of the year were estimated at 696,000 tons of developed and probable ore—a decrease of 59,000 tons from the estimated tonnage at the end of 1944.

The Little Pittsburg mine on Denver Creek was operated under lease throughout the year by the Denver Development Co.; 42,244 tons of ore, containing an average of 1.30 ounces of silver to the ton, 3.21 percent lead, and 7.77 percent zinc, were treated in the company 150-ton flotation mill, which yielded 1,057 tons of zinc-lead concentrate and 4,782 tons of zinc concentrate. Mining and milling of zinc-lead ore from the Highland-Surprise mine on Stewart Creek by the Highland-Surprise Consolidated Mining Co. were continuous in 1945. The company 200-ton flotation mill treated 30,528 tons of ore yielding 4,292 tons of zinc-lead concentrate. About 26,150 tons of ore, containing an average of 3.06 ounces of silver to the ton, 4.57 percent lead, and 9.12 percent zinc, were produced during the year from the Spokane-Idaho property on Pine Creek and treated in the company 150-ton flotation mill. The Small Leasing Co. continued operating the Douglas mine, also on Pine Creek, and treated 19,116 tons of zinc-lead ore in its 100-ton flotation mill, which yielded 3,046 tons of zinc-lead concentrate. Mining and milling of zinc-lead-silver ore from the Sidney mine on Denver Creek by the Sidney Mining Co. were continuous throughout the year. The company reported that 12,900 tons of ore (containing an average of 2.82 ounces of silver to the ton, 6.37 percent lead, and 12.71 percent zinc) were treated in its own

50-ton mill and 4,386 tons in a custom mill. In September the company began erecting a new 250-ton milling plant. About 15,400 tons of zinc-lead ore were produced in 1945 from the Liberal King mine by the Sunset Minerals, Inc., and treated in the company 100-ton flotation mill. The rest of the district output was mainly 4,402 tons of silver-lead-iron fluxing ore shipped direct to a smelter from the Sierra-Nevada waste dump and 3,990 tons of zinc-lead ore produced from the Nabob mine during the first 6 months of the year. The Lynch-Pine Creek Mining Co. relinquished its lease on the Nabob mine in June; during the remainder of the year the property was developed by the owner—Nabob Silver-Lead Co. In September the company began erecting a new 250-ton flotation mill.

VALLEY COUNTY

Deadwood Basin district.—Production of gold, silver, copper, lead, and zinc in the Deadwood Basin district was much greater in 1945 than in 1944, owing to continuous milling of zinc-lead-silver ore from the Hall-Interstate property by the Callahan Zinc-Lead Co. The company reported that 24,377 tons of ore, containing an average of 0.02 ounce of gold and 3.89 ounces of silver to the ton, 0.23 percent copper, 1.43 percent lead, and 3.53 percent zinc, were treated in its 100-ton flotation mill. According to the printed annual report of the company, 4 years of unremitting effort at the Hall-Interstate mine has failed to disclose ore of the grade and quantity hoped for, and despite maximum Premium Price Plan payments for lead and zinc in 1945 operations were disappointing.

Yellow Pine district.—Gold-silver-iron-antimony-tungsten ore was mined 8 months of the year from the open pit at the Yellow Pine mine by the Bradley Mining Co. and treated in the company 800-ton flotation mill. During August, September, October, and November the company treated only old tungsten tailings. In 1945 the mill treated 109,796 tons of ore and 47,359 tons of old tailings, yielding 5,098 tons of low-grade tungsten concentrate, 138 tons of high-grade tungsten concentrate, 2,500 tons of antimony-silver-gold concentrate, and 2,308 tons of gold-silver-antimony-iron concentrate. The remainder of the district output was 10 tons of gold-silver ore produced from the Red Metals claim.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN MONTANA

(MINE REPORT)

By C. E. Needham and Paul Luff

SUMMARY OUTLINE

SUMMARY

Zinc bore the brunt of the pronounced decrease in metal production in Montana in 1945, showing a drop in output of 52 percent from that in 1944. Declines in output of the other four metals, although not so great, were nevertheless marked—gold, 11 percent; silver, 16 percent; copper, 25 percent; and lead, 24 percent. The downward trend in total value of the five metals, in progress since 1942, grew steeper in 1945 despite slightly higher average prices for lead and zinc. The drop from $49,039,855 in 1944 to $35,405,505 in 1945 was nearly 28 percent. Copper contributed over 67 percent of the total value, silver 12, zinc 11, lead 5, and gold over 4. The sharp slump in metal output resulted largely from the acute labor shortage at mines, mills, and smelters, especially at Butte and Anaconda.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Montana, 1941–45, and total, 1862–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	612	325	5, 642, 249	246, 475	$8, 626, 625	12, 386, 925	$8, 808, 480
1942	370	170	5, 678, 280	146, 892	5, 141, 220	11, 188, 118	7, 955, 995
1943	227	45	5, 873, 016	59, 586	2, 085, 510	8, 450, 370	6, 009, 152
1944	188	24	6, 049, 462	50, 021	1, 750, 735	7, 093, 215	5, 044, 064
1945	160	26	4, 919, 562	44, 597	1, 560, 895	5, 942, 070	4, 225, 472
1862–1945	-	-	(1)	16, 981, 614	378, 809, 702	745, 876, 683	544, 431, 355

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	256, 072, 000	$30, 216, 496	42, 518, 000	$2, 423, 526	121, 420, 000	$9, 106, 500	$59, 181, 627
1942	282, 388, 000	34, 168, 948	40, 100, 000	2, 686, 700	109, 430, 000	10, 176, 990	60, 129, 853
1943	269, 050, 000	34, 976, 500	32, 648, 000	2, 448, 600	75, 212, 000	8, 122, 896	53, 642, 658
1944	236, 380, 000	31, 911, 300	26, 210, 000	2, 096, 800	72, 254, 000	8, 236, 956	49, 039, 855
1945	177, 012, 000	23, 896, 620	19, 998, 000	1, 719, 828	34, 806, 000	4, 002, 690	35, 405, 505
1862–1945	[2] 6, 519, 872	1, 882, 852, 830	[2] 686, 720	75, 459, 596	[2] 1, 845, 518	285, 330, 962	3, 166, 884, 445

[1] Figures not available. [2] Short tons.

Gold produced at placer mines in Montana, 1941–45, by classes of mines and by methods of recovery

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Connected-bucket dredges:					
1941	7	9, 124, 765	33, 844	$1, 184, 540	$0. 130
1942	7	7, 191, 603	31, 283	1, 094, 905	. 152
1943	3	3, 215, 759	13, 579	475, 265	. 148
1944	2	1, 197, 600	5, 887	206, 045	. 172
1945	2	1, 497, 646	9, 181	321, 335	. 215
Dragline dredges:					
1941	5	1, 233, 524	10, 660	373, 100	. 302
1942	4	505, 454	3, 553	124, 355	. 246
1943	-	-	-	-	-
1944	-	-	-	-	-
1945	2	33, 500	359	12, 565	. 375
Nonfloating washing plants: [1]					
1941	35	2, 866, 267	14, 663	513, 205	. 179
1942	10	409, 123	3, 674	128, 590	. 314
1943	-	-	-	-	-
1944	-	-	-	-	-
1945	1	3, 000	30	1, 050	. 350
Gravel hydraulically handled:					
Hydraulic:					
1941	10	26, 600	236	8, 260	. 311
1942	2	18, 000	102	3, 570	. 198
1943	1	500	2	70	. 140
1944	3	3, 750	16	560	. 149
1945	2	420	8	280	. 667

Gold produced at placer mines in Montana, 1941–45, by classes of mines and by methods of recovery—Continued

Class and method	Mines producing	Material treated (cubic yards)	Gold recovered: Fine ounces	Gold recovered: Value	Gold recovered: Average per cubic yard
Surface placers—Continued.					
Small-scale hand methods:					
Wet:					
1941	253	72, 010	2, 069	$72, 415	$1. 006
1942	147	102, 485	2, 630	92, 050	. 898
1943	39	5, 925	484	16, 940	2. 859
1944	18	4, 100	318	11, 130	2. 715
1945	19	4, 165	112	3, 920	. 941
Underground placers:					
Drift:					
1941	15	5, 300	139	4, 865	. 918
1942					
1943	2	175	7	245	1. 400
1944	1	25	2	70	2. 800
1945					
Grand total placer:					
1941	325	13, 328, 466	61, 611	2, 156, 385	. 162
1942	170	8, 226, 665	41, 242	1, 443, 470	. 175
1943	45	3, 222, 359	14, 072	492, 520	. 153
1944	24	1, 205, 475	6, 223	217, 805	. 181
1945	26	1, 538, 731	9, 690	339, 150	. 220

[1] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."

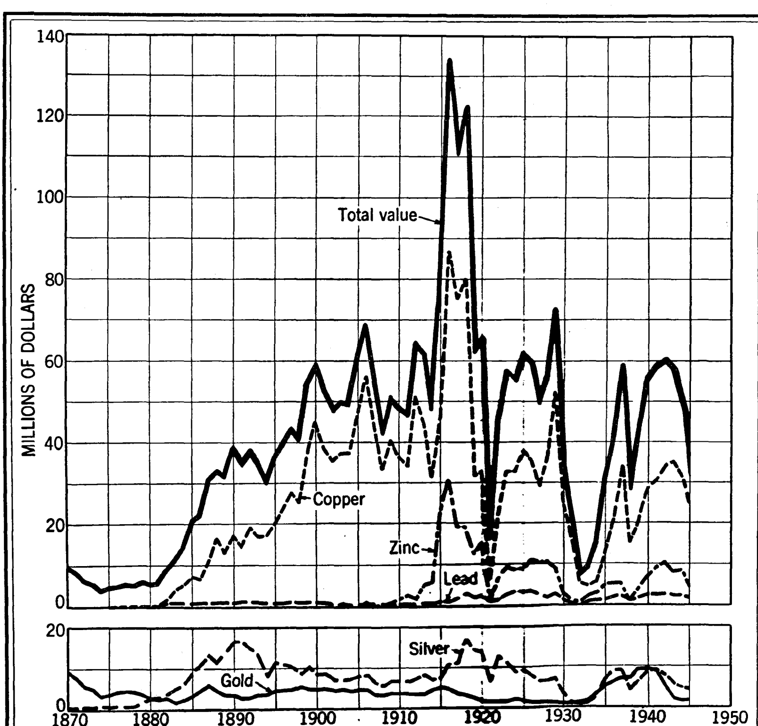

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Montana, 1870–1945.

Mine production of gold, silver, copper, lead, and zinc in Montana in 1945, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	3,032	562,163	17,846,000	1,398,000	3,112,000
February	3,591	508,566	15,916,000	1,570,000	3,030,000
March	2,854	570,842	17,920,000	1,772,000	3,402,000
April	3,161	478,858	15,466,000	1,812,000	3,332,000
May	2,894	547,532	16,948,000	2,096,000	3,156,000
June	3,355	548,010	16,170,000	1,644,000	2,930,000
July	4,177	508,228	13,372,000	1,754,000	2,862,000
August	4,612	494,216	12,464,000	1,328,000	1,998,000
September	4,807	490,214	12,722,000	1,524,000	2,058,000
October	4,472	501,227	14,154,000	1,786,000	2,462,000
November	3,998	421,204	13,158,000	1,806,000	3,442,000
December	3,644	311,010	10,876,000	1,508,000	3,022,000
	44,597	5,942,070	177,012,000	19,998,000	34,806,000
Total, 1944	50,021	7,093,215	236,380,000	26,210,000	72,254,000

Gold.—Base-metal mines supplied the greater part of Montana gold production in 1945, although some improvement in the status of the gold-mining industry was noted following the rescinding, July 1, of War Production Board Order L-208. The 11-percent drop in gold output in 1945 compared with 1944 can be attributed mainly to lower production from the copper-producing operations of the Anaconda Copper Mining Co. and to reduced output from a number of fairly important gold mines.

Placer mining regained some of its importance in 1945, particularly following the revocation of WPB Order L-208, and 56 percent more gold was recovered from gravels than in 1944. Greater activity was recorded in connected-bucket and dragline dredging; but output from hydraulicking, small-scale hand methods, and drift mining declined. Connected-bucket dredges showed an increase over 1944 of 25 percent in quantity of gravel washed and 56 percent in value of gold recovered. The two operations—one in Granite County and the other in Lewis and Clark County—washed 97 percent of the total gravel mined in the State in 1945 and produced 95 percent of the State placer gold.

Of Montana's total gold in 1945, 45 percent was derived from siliceous gold and silver ores, 33 percent from base-metal ores, and 22 percent from placers, compared with 51 percent from siliceous ores, 36 percent from base-metal ores, and 13 percent from placers in 1944. Ores concentrated yielded 32 percent of the State total gold; ores shipped to smelters, nearly 28 percent; and ores treated at amalgamation and cyanidation mills (with or without concentrating equipment), over 18 percent.

The leading gold producers in Montana in 1945 were the Anaconda Copper Mining Co. (copper ore and waste materials) at Butte and Anaconda; Jardine Mining Co. (gold ore) at Jardine; Porter Bros. (placer); H. and H. mines (placer); the Golden Sunlight mine (gold ore) near Whitehall; the Granite-Bimetallic tailing dump (gold-silver ore) at Philipsburg; and the U. S. Grant mine (gold-silver ore) near Virginia City. These seven producers furnished 78 percent of the State total gold.

Silver.—Although the output of recoverable silver in Montana in 1945 decreased 1,151,145 ounces from that in 1944, the State remained the Nation's third leading silver producer, being exceeded only by

Idaho and Utah. The decline in silver output from the previous year resulted mainly from a much smaller output of byproduct silver from the copper-producing operations of the Anaconda Copper Mining Co. at Butte and Anaconda. However, the company, from its copper mines, mine dumps, tailing dumps, slime ponds, zinc mines, and the North Butte and Flathead mines, supplied 77 percent of the State total compared with 79 percent in 1944. Other important sources of silver were the Emma mine at Butte, the Granite-Bimetallic tailing dump at Philipsburg, the Mike Horse mine at Flesher, and the Elkhorn dump at Elkhorn.

Copper ore and tailings furnished over 75 percent of the State total silver; siliceous ores, 11 percent; zinc-lead ore, nearly 11 percent; and lead ore and zinc ore, less than 3 percent. Ore treated at concentrating mills yielded 87 percent of the total silver, and smelting ore over 12 percent; minor sources were slag fumed, ores amalgamated or cyanided in plants with or without concentrating equipment, and placers.

The mining of straight silver ore in 1945 did not keep pace with the 1944 rate, and production declined over 10,000 tons. However, the grade of ore was higher in 1945, and output of recoverable silver from this source was greater than in 1944.

Copper.—The output of recoverable copper in Montana in 1945 dropped 59,368,000 pounds from that in 1944 and was the lowest since 1938. The sharp decline was due largely to the marked decrease in tonnage of crude mine ore and waste material from the properties of the Anaconda Copper Mining Co. at Butte and Anaconda. The Anaconda Co. supplied about 95 percent of the State total copper, and the North Butte mine at Butte furnished all but a very small part of the remainder. The production of copper in the Butte district declined from 234,725,400 pounds in 1944 to 175,895,800 pounds in 1945, a decrease of 25 percent.

Lead.—Most lead-producing properties and districts in Montana showed declines in lead output in 1945, and State production dropped 6,212,000 pounds from that in 1944 to reach the lowest point since 1938. In opposition to the general downward trend the Mike Horse mine near Flesher made a substantial increase in lead production. Following the Mike Horse mine as the leading lead producer in the State were the Emma mine at Butte, the Jack Waite mine in Sanders County, the Toledo-Buckeye group near Sheridan, the Poulin mine at Butte, the Orphan Girl and Travona mines at Butte, and the Elkhorn dump at Elkhorn. These seven sources contributed over 14,000,000 pounds, or 70 percent, of Montana's total lead. About 72 percent of the State lead output was recovered from zinc-lead ore, 10 percent from zinc ore and slag, 10 percent from siliceous ores, and 8 percent from lead ore.

Zinc.—Zinc experienced the greatest percentage decline in production in 1945 of any of the five metals in Montana; output of recoverable zinc was 37,448,000 pounds, or 52 percent less than in 1944. The loss resulted principally from the marked decline in zinc output from the zinc slag-fuming plant at East Helena and from the Silver Cable, Mount Washington, and Iron Mask properties. The leading producers of zinc in 1945, in order of output, were the Emma (manganese ore), Anaconda slag-fuming plant (old lead-smelter slag), Mike Horse (zinc-lead ore), Poulin (zinc ore), Toledo-Buckeye (zinc-lead ore), Orphan Girl and Travona (zinc-lead ore), Elkhorn dump (silver ore), and Forest Rose (zinc ore). These eight sources contributed nearly 81 percent of Montana's total zinc in 1945. About 62 percent of the State total zinc was derived from zinc-lead ore, 32 percent from zinc ore and slag, and nearly all the remainder from siliceous gold and silver ores.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Montana in 1945, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Beaverhead	4		811	$28,385	53,865	$38,304
Broadwater	17	1	638	22,330	33,615	23,904
Cascade	6		163	5,705	75,285	53,536
Deer Lodge		1	2	70		
Fergus		1	2	70		
Flathead	1		42	1,470	40,500	28,800
Granite	10	3	7,079	247,765	258,840	184,064
Jefferson	35		5,523	193,305	158,850	112,960
Judith Basin	3		52	1,820	3,240	2,304
Lewis and Clark	16	5	6,270	219,450	177,570	126,272
Lincoln	3	2	65	2,275	1,485	1,056
Madison	23	4	2,636	92,260	125,775	89,440
Meagher		1	2	70		
Mineral	3		5	175	3,330	2,368
Missoula	2	2	83	2,905	135	96
Park	4	1	8,454	295,890	22,050	15,680
Phillips	1		43	1,505	45	32
Powell	5	4	79	2,765	1,800	1,280
Ravalli	1		76	2,660	2,385	1,696
Sanders	3		88	3,080	6,390	4,544
Silver Bow	23	1	12,484	436,940	4,976,910	3,539,136
	160	26	44,597	1,560,895	5,942,070	4,225,472
Total, 1944	188	24	50,021	1,750,735	7,093,215	5,044,064

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaverhead	79,000	$10,665	709,500	$61,017	323,800	$37,237	$175,608
Broadwater	7,200	972	528,000	45,408	1,432,400	164,726	257,340
Cascade	8,800	1,188	949,000	81,614	1,906,600	219,259	361,302
Deer Lodge							70
Fergus							70
Flathead	6,000	810					31,080
Granite	295,600	39,906	745,500	64,113	1,272,600	146,349	682,197
Jefferson	33,400	4,509	1,294,000	111,284	1,506,600	173,259	595,317
Judith Basin	17,600	2,376	40,500	3,483	16,200	1,863	11,846
Lewis and Clark	420,000	56,700	7,416,500	637,819	8,391,600	965,034	2,005,275
Lincoln	1,000	135	46,000	3,956	70,000	8,050	15,472
Madison	68,600	9,261	817,500	70,305	1,756,400	201,986	463,252
Meagher							70
Mineral	9,000	1,215	163,000	14,018	512,000	58,880	76,656
Missoula	5,400	729	3,500	301	800	92	4,123
Park	41,800	5,643	171,500	14,749	134,200	15,433	347,395
Phillips							1,537
Powell	200	27	22,500	1,935	16,400	1,886	7,893
Ravalli	7,400	999	42,000	3,612	273,000	31,395	40,362
Sanders	111,800	15,093	1,197,500	102,985	207,000	23,805	149,507
Silver Bow	175,899,200	23,746,392	5,851,500	503,229	16,986,400	1,953,436	30,179,133
	177,012,000	23,896,620	19,998,000	1,719,828	34,806,000	4,002,690	35,405,505
Total, 1944	236,380,000	31,911,300	26,210,000	2,096,800	72,254,000	8,236,956	49,039,855

Gold and silver produced at lode mines in Montana in 1945, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounes)
Beaverhead	7,937	811	53,865	Missoula	129	73	135
Broadwater	14,812	625	33,615	Park	49,723	8,451	22,050
Cascade	35,141	163	75,285	Phillips	12	43	45
Flathead	1,437	42	40,500	Powell	520	19	1,800
Granite	75,665	2,617	258,570	Ravalli	4,050	76	2,385
Jefferson	36,944	5,523	158,850	Sanders	5,447	88	6,390
Judith Basin	707	52	3,240	Silver Bow	4,528,282	12,474	4,976,910
Lewis and Clark	109,704	1,521	177,075				
Lincoln	4,015	58	1,485		4,919,562	34,907	5,941,260
Madison	40,492	2,266	125,730	Total, 1944	6,049,462	43,798	7,092,720
Mineral	4,545	5	3,330				

MINING INDUSTRY

The labor shortage at the mines, mills, and smelters in Montana in 1945 was the most acute yet experienced during World War II and was the principal factor in reducing the total output of ore and of old tailings treated by 1,129,900 tons (nearly 19 percent) below that in 1944. The greatest decline was in output of zinc ore and slag—56 percent—but loss in production of zinc-lead ore also was high—36 percent.

The number of producing lode mines declined from 188 in 1944 to 160 in 1945; only zinc-ore mines increased in number.

About 91 percent of the total ore and tailings treated in 1945 was copper ore, 4 percent was siliceous gold and silver ores, 3 percent was zinc-lead ore, and 2 percent was zinc ore and lead ore.

Copper ore mined at Butte declined from 2,559,796 tons in 1944 to 1,924,775 tons in 1945, and waste-dump ore from 879,879 tons to 489,469 tons; but old tailings and slimes increased from 1,906,626 tons to 2,059,648 tons. The Heddleston district was an exception to the general trend and showed a substantial increase in ore production. Compared with 1944, the grade of primary copper ore treated in the Butte district in 1945 decreased about 0.4 pound of recoverable copper per ton of copper ore.

The Bureau of Mines made preliminary examinations during the year on a number of base-metal deposits and conducted diamond drilling at a few properties.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Montana in 1945, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	47	65,776	14,671	13,834	44,697	41,006	28,587
Dry and siliceous gold-silver ore	22	67,867	4,408	316,691	198,363	796,159	144,425
Dry and siliceous silver ore	30	55,070	1,025	320,221	412,361	1,089,674	1,546,933
	99	188,713	20,104	650,746	655,421	1,926,839	1,719,945
Copper ore	10	4,463,131	11,378	4,487,436	[1] 175,372,169		
Lead ore	31	14,919	840	52,641	53,805	1,625,296	190,116
Zinc ore	12	[2] 87,801	438	116,298	153,346	1,960,336	11,238,012
Zinc-lead ore	33	164,998	2,147	634,139	777,259	14,485,529	21,657,927
Total, lode mines	[3] 160	4,919,562	34,907	5,941,260	[1] 177,012,000	19,998,000	34,806,000
Total, placers	26		9,690	810			
	186	4,919,562	44,597	5,942,070	[1] 177,012,000	19,998,000	34,806,000
Total, 1944	212	6,049,462	50,021	7,093,215	[4] 236,380,000	26,210,000	72,254,000

[1] Includes 5,803,665 pounds recovered from precipitates.
[2] Includes 25,711 tons of old lead smelter slag fumed.
[3] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[4] Includes 4,173,664 pounds recovered from precipitates.

METALLURGIC INDUSTRY

The 4,919,562 tons of ore produced from Montana lode mines in 1945 were treated as follows: 4,664,259 tons (95 percent) at concentrating mills, compared with 5,569,756 tons in 1944; 183,037 tons (nearly 4 percent) shipped to smelters, compared with 240,783 tons in 1944; 25,711 tons of old lead-smelter slag fumed, compared with 187,988 tons in 1944; 45,217 tons (nearly 1 percent) at amalgamation-cyanidation-concentration mills, compared with 50,430 tons in 1944; and 1,338 tons at amalgamation mills compared with 505 tons in 1944. The ore that went to concentrating mills comprised 4,418,846 tons of copper ore, 161,306 tons of zinc-lead ore, 58,363 tons of zinc ore, 15,634 tons of siliceous ore, and 10,110 tons of lead ore.

The 12,320-ton copper concentrator, the 2,000-ton zinc concentrator, and the 2,000-ton slime-disintegrating plant of the Anaconda Copper Mining Co., all at Anaconda, were operated continuously in 1945, but at reduced rates. The company copper smelter (annual capacity, 1,300,000 tons of charge) and the two electrolytic zinc plants at Anaconda and Great Falls (combined capacity, 233,400 tons of slab zinc per year) also were operated throughout the year below capacity. The zinc plants treated 394,110 tons of zinc concentrates containing 425,699,262 pounds of zinc, compared with 469,412 tons containing 510,740,695 pounds of zinc in 1944. The concentrates were received from mills in Idaho, California, Montana, Nevada, New Mexico, Utah, Colorado, and several foreign countries. The company zinc-fuming plant at East Helena was operated at below capacity (about 16,500 tons of slag per month) throughout the year except for short shut-downs for repairs. The output of zinc-lead fume decreased from 38,115 tons in 1944 to 32,233 tons in 1945; nearly all was treated at Anaconda's Great Falls zinc plant.

The lead smelter of the American Smelting & Refining Co., at

East Helena treated chiefly lead-silver concentrates from the Coeur d'Alene region in Idaho, residues from the electrolytic zinc plants of the Anaconda Copper Mining Co. at Anaconda and Great Falls, and crude ores, old tailings, and concentrates from various districts in Montana. The plant was operated continuously in 1945, except for brief repair periods.

Details of treatment of all ores produced in Montana in 1945 are given in the tables that follow.

Mine production of metals in Montana in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Ore amalgamated	1,338	200	40			
Ore cyanided	45,217	7,747	1,592			
Concentrates smelted [1]	422,070	14,635	5,188,080	167,580,415	15,946,075	27,532,573
Copper precipitates smelted	4,218			5,803,665		
Ore smelted	183,037	12,325	747,368	3,627,920	3,621,925	2,923,427
Slag fumed	25,711		4,180		430,000	4,350,000
Placer		9,690	810			
		44,597	5,942,070	177,012,000	19,998,000	34,806,000
Total, 1944		50,021	7,093,215	236,380,000	26,210,000	72,254,000

[1] Includes zinc concentrates treated at electrolytic plants.

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Montana in 1945, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal					
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Broadwater	390	41	3						
Jefferson	357	100	18	7	20	127		837	200
Lewis and Clark	176	50	17	22	249	2,233	281	2,087	1,255
Lincoln	15	5							
Madison	400	4	2	5	5	16			
	1,338	200	40	34	274	2,376	281	2,924	1,455
Total, 1944	505	137	9	4	5	20		783	

CYANIDATION MILLS

County	Ore treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Park	45,217	7,747	1,592	81	65	28			
	45,217	7,747	1,592	81	65	28			
Total, 1944	50,430	5,879	1,526	693	1,264	416			
Grand total: 1945	46,555	7,947	1,632	115	339	2,404	281	2,924	1,455
1944	50,935	6,016	1,535	697	1,269	436		783	

Mine production of metals from concentrating mills in Montana in 1945, by counties, in terms of recovered metals

County	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Broadwater	10, 046	1, 367	173	18, 429	4, 484	262, 159	890, 953
Cascade	35, 141	3, 073	163	75, 285	8, 800	949, 000	1, 906, 600
Granite	19, 509	1, 220	12	5, 580	37, 600	58, 500	1, 141, 200
Jefferson	655	95	5	968	767	29, 158	56, 790
Judith Basin	600	38	29	168	15, 947		
Lewis and Clark	81, 692	9, 857	715	158, 641	414, 627	6, 852, 220	3, 857, 720
Lincoln	35, 517	2, 421	453	35, 794	57, 913	803, 110	1, 801, 928
Mineral	4, 536	621	5	3, 330	8, 600	163, 000	512, 000
Park	4, 388	364	611	15, 840	41, 707	128, 601	113, 931
Powell	494	44	18	1, 461	200	16, 273	16, 051
Ravalli	4, 050	295	76	2, 385	7, 400	42, 000	273, 000
Sanders	4, 914	901	64	4, 878	66, 317	998, 958	193, 755
Silver Bow	4, 462, 717	401, 659	11, 972	4, 862, 917	166, 915, 772	5, 640, 172	16, 767, 190
	4, 664, 259	421, 955	14, 296	5, 185, 676	167, 580, 134	15, 943, 151	27, 531, 118
Total, 1944	5, 569, 756	530, 529	20, 117	6, 247, 735	226, 002, 399	17, 286, 634	27, 540, 393

Gross metal content of concentrates produced from ore mined in Montana in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	115	345	2, 395	331	2, 639	1, 914
Copper	327, 614	11, 109	4, 421, 011	172, 304, 168		
Lead	12, 127	1, 723	366, 216	534, 733	12, 749, 846	1, 692, 286
Zinc	27, 299	1, 132	300, 722	471, 433	2, 550, 497	26, 346, 417
Zinc-lead	1, 820	277	67, 005	30, 004	1, 063, 992	481, 641
Dry iron (from zinc-lead ore)	53, 095	50	30, 884	600, 606	9, 283	34, 903
	422, 070	14, 636	5, 188, 233	173, 941, 275	16, 376, 257	28, 557, 161
Total, 1944	531, 226	21, 392	6, 249, 319	228, 856, 592	17, 837, 913	30, 454, 970

Mine production of metals from Montana concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Broadwater	1, 367	173	18, 429	4, 484	262, 159	890, 953
Cascade	3, 073	163	75, 285	8, 800	949, 000	1, 906, 600
Granite	1, 220	12	5, 580	37, 600	58, 500	1, 141, 200
Jefferson	102	25	1, 095	767	29, 995	56, 990
Judith Basin	38	29	168	15, 947		
Lewis and Clark	9, 879	964	160, 874	414, 908	6, 854, 307	3, 858, 975
Lincoln	2, 421	453	35, 794	57, 913	803, 110	1, 801, 928
Madison	5	5	16			
Mineral	621	5	3, 330	8, 600	163, 000	512, 000
Park	445	676	15, 868	41, 707	128, 601	113, 931
Powell	44	18	1, 461	200	16, 273	16, 051
Ravalli	295	76	2, 385	7, 400	42, 000	273, 000
Sanders	901	64	4, 878	66, 317	998, 958	193, 755
Silver Bow	401, 659	11, 972	4, 862, 917	166, 915, 772	5, 640, 172	16, 767, 190
	422, 070	14, 635	5, 188, 080	167, 580, 415	15, 946, 075	27, 532, 573
Total, 1944	531, 226	21, 386	6, 248, 171	226, 002, 399	17, 287, 417	27, 540, 393

Mine production of metals from Montana concentrates shipped to smelters in 1945, in terms of recovered metals—Continued

BY CLASSES OF CONCENTRATES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	115	345	2,395	281	2,587	1,455
Copper	327,614	11,109	4,421,011	166,076,682		
Lead	12,127	1,723	366,216	454,370	12,540,669	1,360,723
Zinc	27,299	1,131	300,569	447,616	2,347,143	25,767,620
Zinc-lead	1,820	277	67,005	25,260	1,047,517	402,775
Dry iron (from zinc-lead ore)	53,095	50	30,884	576,206	8,159	
	422,070	14,635	5,188,080	167,580,415	15,946,075	27,532,573

Gross metal content of Montana crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	18,616	6,350	9,630	30,154	38,985	33,314
Dry and siliceous gold-silver	59,005	4,083	303,967	200,651	871,241	30,697
Dry and siliceous silver	48,903	988	299,874	535,280	1,081,072	1,812,580
Copper	44,285	298	42,596	3,028,660		
Lead	4,809	407	46,471	29,698	1,220,002	185,974
Zinc	3,727	32	14,456	6,217	219,929	894,689
Zinc-lead	3,692	167	30,374	28,705	597,485	667,977
	183,037	12,325	747,368	3,859,365	4,028,714	3,625,231
Total, 1944	240,783	16,396	812,269	5,811,815	6,960,436	8,771,085

Mine production of metals from Montana crude ore shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaverhead	7,937	811	53,865	79,000	709,500	323,800
Broadwater	4,376	411	15,183	2,716	265,841	541,447
Flathead	1,437	42	40,500	6,000		
Granite	56,156	2,605	252,990	258,000	687,000	131,400
Jefferson	35,932	5,398	157,737	32,633	1,264,005	1,449,610
Judith Basin	107	23	3,072	1,653	40,500	16,200
Lewis and Clark	2,125	507	12,004	5,092	132,193	182,625
Madison	8,575	1,857	91,403	11,687	60,390	24,472
Mineral	9			400		
Missoula	129	73	135	5,400	3,500	800
Park	118	28	4,590	93	42,899	20,269
Phillips	12	43	45			
Powell	26	1	339		6,227	349
Sanders	533	24	1,512	45,483	198,542	13,245
Silver Bow	65,565	502	113,993	3,179,763	211,328	219,210
	183,037	12,325	747,368	3,627,920	3,621,925	2,923,427
Total, 1944	240,783	16,396	812,269	5,663,937	6,502,408	4,553,107

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	18,616	6,350	9,630	28,469	38,082	27,132
Dry and siliceous gold-silver	59,005	4,083	303,967	193,822	577,830	25,274
Dry and siliceous silver	48,903	988	299,874	411,893	1,004,529	1,486,090
Copper	44,285	298	42,596	2,941,563		
Lead	4,809	407	46,471	22,380	1,196,710	151,812
Zinc	3,727	32	14,456	5,219	216,953	720,841
Zinc-lead	3,692	167	30,374	24,574	587,821	512,278
	183,037	12,325	747,368	3,627,920	3,621,925	2,923,427

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Montana in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Beaverhead County:													
Argenta	2		1,560	151		151	3,285		3,285	6,600	249,000	6,400	$30,662
Bryant	1		6,346	660		660	49,185		49,185	72,400	460,500	317,400	143,954
Vipond	1		31				1,395		1,395				992
Broadwater County:													
Beaver	9		6,813	395		395	9,225		9,225	3,600	133,000	87,000	42,314
Cedar Plains	6		3,180	171		171	9,495		9,495	1,600	188,000	333,000	67,416
Park or Indian Creek	2	1	4,819	59	13	72	14,895		14,895	2,000	207,000	1,012,400	147,610
Cascade County:													
Barker [1]	1		559	1		1	2,610		2,610	600	74,000	228,600	34,625
Montana	5		34,582	162		162	72,675		72,675	8,200	875,000	1,678,000	326,677
Deer Lodge County: Dry Gulch		1			2	2							70
Fergus County: North Moccasin		1			2	2							70
Flathead County: Hog Heaven	1		1,437	42		42	40,500		40,500	6,000			31,080
Granite County:													
Boulder and South Boulder	1		171	16		16	21,555		21,555	6,200	51,000	3,200	21,479
Dunkleberg	1		19,504	6		6	5,580		5,580	37,600	58,500	1,141,200	145,523
First Chance	3	2	13	3	23	26	180		180				1,038
Flint Creek	4		52,963	2,449		2,449	208,260		208,260	178,000	493,500	101,000	311,897
Henderson	1	1	3,014	143	4,439	4,582	22,995	270	23,265	73,800	142,500	27,200	202,260
Jefferson County:													
Amazon	1		59	13		13	630		630	1,000	5,500	3,200	1,879
Big Foot and State Creek	2		334	11		11	900		900	400	39,500	10,200	5,649
Boulder and Little Boulder	2		93	6		6	675		675	200	3,500	3,400	1,409
Cataract	10		1,126	142		142	15,840		15,840	2,400	70,000	18,000	24,648
Clancey	1		5				495		495		500	600	464
Colorado	5		2,018	108		108	9,000		9,000	2,400	152,500	203,000	46,964
Elkhorn	4		18,563	740		740	123,435		123,435	14,000	569,500	1,198,200	302,336
Montana City	1		16	16		16	45		45				592
Whitehall	8		14,443	4,371		4,371	7,695		7,695	13,000	452,500	69,800	207,154
Wilson and Ticer Creeks	1		287	116		116	135		135		500	200	4,222
Judith Basin County:													
Barker [1]	1		67	2		2	2,925		2,925	800	40,500	16,200	7,604
Yogo	2		640	50		50	315		315	16,800			4,242
Lewis and Clark County:													
Blue Cloud	2		40	10		10	90		90		2,500	800	721
Dry Gulch		1			1	1							35
Heddleston	2		71,081	109		109	147,330		147,330	382,200	6,350,500	3,755,800	1,138,240
Helena	1	2	5	1	4,743	4,744		495	495				166,392
Lincoln		1			4	4							140
Marysville	4		9,294	1,127		1,127	8,280		8,280	30,800	371,000	36,600	85,606
McClellan Gulch	1		1	2		2							70

Rimini	4		2,920	272		272	17,010		17,010	4,400	246,500	129,400	58,290
Scratch Gravel	1		1								500		43
Smelter	1		26,362				4,365		4,365	2,600	445,500	4,469,000	555,703
Wolf Creek		1			1	1							35
Lincoln County:													
Libby	1	2	4,000	53	7	60	1,485		1,485	1,000	46,000	70,000	15,297
West Fisher Creek	2		15	5		5							175
Madison County:													
McCarthy Mountain	1		150	7		7	855		855	200	36,500	9,400	5,100
Norris and Norwegian	6		522	245		245	315		315		3,500	1,600	9,284
Renova	1		2	2		2							70
Rochester	3		110	11		11	945		945	600	24,000	19,200	5,410
Sheridan	3	2	31,883	403	29	432	36,315		36,315	65,600	739,500	1,722,200	311,450
Silver Star	1		126	236		236	495		495		3,000	600	8,939
Tidal Wave	4		387	182		182	630		630	2,200	11,000	3,400	8,452
Virginia City	3	2	7,302	1,168	341	1,509	86,130	45	86,175				114,095
Washington	1		10	12		12	45		45				452
Meagher County: Beaver and Thomas Creeks		1			2	2							70
Mineral County:													
Iron Mountain	1		9							400			54
Keystone	1		1,811	1		1	990		990	1,200	48,500	3,400	5,463
Packer Creek	1		2,725	4		4	2,340		2,340	7,400	114,500	508,600	71,139
Missoula County:													
Coloma	1		44	71		71	90		90	200		200	2,599
Copper Cliff	1		85	2		2	45		45	5,200	3,500	600	1,174
Nine Mile		2			10	10							350
Park County:													
Emigrant Creek		1			3	3							105
New World	3		4,506	639		639	20,430		20,430	41,800	171,500	134,200	72,718
Sheepeater	1		45,217	7,812		7,812	1,620		1,620				274,572
Phillips County: Little Rockies	1		12	43		43	45		45				1,537
Powell County:													
Big Blackfoot		1			10	10							350
Finn		1			30	30							1,050
Nigger Hill	4	1	470	12	1	13	1,575		1,575	200	21,500	15,600	5,245
Pioneer		1			19	19							665
Zozell	1		50	7		7	225		225		1,000	800	583
Ravalli County: Curlew	1		4,050	76		76	2,385		2,385	7,400	42,000	273,000	40,362
Sanders County:													
Camas Prairie	1		345	5		5	585		585	25,800			4,074
Eagle	1		4,690	9		9	5,580		5,580	11,400	1,197,500	207,000	132,612
Revais Creek	1		412	74		74	225		225	74,600			12,821
Silver Bow County:													
German Gulch		1			10	10							350
Independence	1		9				90		90				64
Smelter	1		1,750	422		422	40,050		40,050	3,400	111,500	259,000	83,083
Summit Valley (Butte)	21		4,526,523	12,052		12,052	4,936,770		4,936,770	175,895,800	5,740,000	16,727,400	30,095,636
Total Montana	160	26	4,919,562	34,907	9,690	44,597	5,941,260	810	5,942,070	177,012,000	19,998,000	34,806,000	35,405,505

[1] Barker district lies in Cascade and Judith Basin Counties.

BEAVERHEAD COUNTY

Argenta district.—Output from the Argenta district in 1945 comprised 686 tons of lead ore from the Iron Mountain mine and 534 tons of gold-silver ore and 340 tons of lead ore from the Louis Phillip mine; all was shipped to smelters.

Bryant district.—From the Hecla mine and dumps L. D. Foreman shipped to smelters in Utah a total of 6,346 tons of material that comprised 2,738 tons of old silver tailings, 2,360 tons of old zinc-lead slag, 648 tons of gold-silver ore, 329 tons of lead ore, and 271 tons of zinc ore.

Vipond district.—The Quartz Hill Leasing Co. operated the Quartz Hill Mines group in 1945 and shipped 31 tons of ore containing 1,395 ounces of silver to the copper smelter at Anaconda.

BROADWATER COUNTY

Beaver district.—H. W. Carver, lessee, worked the East Pacific and No. 4 Tunnel claims in 1945; the milling of about 6,400 tons of old tailings yielded 14 tons of zinc concentrate, 201 tons of lead concentrate, and 32 tons of iron concentrate. In addition, 87 tons of zinc-lead ore were shipped to the lead smelter at East Helena. From the January group George G. E. Neill shipped 100 tons of lead ore and 46 tons of zinc-lead ore to mills in Utah and 7 tons of zinc-lead ore to the East Helena lead smelter. Remaining production from the district totaled 154 tons of gold ore shipped to the East Helena lead smelter from the Aurora, Edna No. 2, Joe Dandy, Martha Washington, Viola, and Vosburg properties.

Cedar Plains district.—The bulk of the output from the Cedar Plains district in 1945 was old tailings and waste dump material—1,361 tons of zinc ore from the Ruby Silver waste dump, 1,064 tons of old cyanide tailings from the Ohio Keating dump, and 170 tons of lead ore from the Joe Dandy waste dump. In addition, zinc and zinc-lead ore were produced from the Ruby Silver mine, lead ore from the North Star property, and gold ore from the Nada and Buckhorn mines. All the output from the district was sent to the East Helena smelter.

Park or Indian Creek district.—The Broadwater Zinc & Lead Co. produced 4,429 tons of zinc ore in 1945 from the Iron Mask mine; 3,500 tons were milled at the Anaconda zinc concentrator, and 929 tons were shipped to the East Helena lead smelter. Other output from the district was 390 tons of gold ore, treated by amalgamation, from the Diamond Hill mine and a little placer gold recovered by sluicing.

CASCADE COUNTY

Barker district.—Total production from the Barker district in 1945 was 559 tons of zinc-lead ore shipped to the Midvale, Utah, concentrator from the Fairplay & Bon Ton group. Gross metal content of the ore was 2 ounces of gold, 2,876 ounces of silver, 856 pounds of copper, 81,320 pounds of lead, and 306,417 pounds of zinc.

Montana district.—The Bennett Mining Co. operated the Dacotah group throughout the year and milled 12,571 tons of zinc ore that yielded 813 tons of zinc concentrate and 404 tons of lead concentrate.

The Neihart Mine & Milling Co. worked the Broadwater group continuously in 1945 and produced 13,324 tons of zinc-lead ore, which was treated in the company 80-ton selective flotation mill; the ore yielded 625 tons of zinc concentrate and 278 tons of zinc-lead concentrate. Development at the property during the year comprised 100 feet of shaft sinking, 100 feet of drifts, and 500 feet of diamond drilling. The Benton group and the Ripple mine were operated by the Montana Leasing Co. in 1945. Output from the Benton group—4,774 tons of silver ore—yielded 327 tons of zinc-lead concentrate, and that from the Ripple mine—1,393 of silver ore—produced 65 tons of zinc-lead concentrate. All concentrates were shipped to the East Helena lead smelter. Loretta L. Rives operated the Star group and the 50-ton flotation mill during the year. The output of 2,520 tons of zinc-lead ore yielded 211 tons of zinc-lead concentrate, which contained 20 ounces of gold, 16,816 ounces of silver, 785 pounds of copper, 142,183 pounds of lead, and 67,361 pounds of zinc.

FLATHEAD COUNTY

Hog Heaven district.—Output of the Hog Heaven district in 1945 was 1,437 tons of siliceous silver ore shipped to the Anaconda copper smelter by the Anaconda Copper Mining Co. from its Flathead and West Flathead mines.

GRANITE COUNTY

Boulder and South Boulder district.—Leon Heroux operated the Annie claim in 1945 and shipped to the East Helena smelter 171 tons of lead ore containing 7,244 pounds of copper, 51,889 pounds of lead, and 4,048 pounds of zinc.

Dunkelburg district.—The Forest Rose Syndicate, operating the Forest Rose, Wasa, and Monarch claims, was the only producer in the Dunkelburg district in 1945. The company 100-ton flotation mill ran continuously and produced 1,137 tons of zinc concentrate and 82 tons of lead concentrate, which were shipped to the Anaconda zinc plant and the East Helena lead smelter, respectively.

First Chance district.—Lode production in the First Chance district in 1945 was all siliceous ore shipped to the Tacoma, Wash., smelter from three claims—8 tons of gold ore from the Homestake and 5 tons of silver ore from the New Hope and Old Tex. Placer production was 23 ounces of gold from the Lucky Jim and Star Pointer properties.

Flint Creek district.—J. C. and Juanita Yob continued to work the Granite-Bimetallic dumps, which produced the bulk of the output from the Flint Creek district in 1945. The Tacoma, Wash., smelter received 48,902 tons of the old tailings, and the East Helena lead smelter the remaining 1,869 tons. The Trout Mining Division of American Machine & Metals, Inc., shipped to smelters 2,119 tons of low-grade gold ore and 40 tons of zinc-lead ore from its Trout group of claims which produce principally manganese ore. Silver ore (28 tons) was sent to the Anaconda copper smelter from the Silver Prince mine.

Henderson district.—The connected-bucket dredge operations of the

H. and H. Mines on Henderson Creek were expanded during the year, and gold output rose from 3,582 ounces in 1944 to 4,439 in 1945 and silver from 225 ounces to 270. Remaining production from the district was 3,014 tons of siliceous silver old tailings shipped to the East Helena lead smelter from the Combination group.

JEFFERSON COUNTY

Amazon district.—A. J. Schevers and A. C. H. Rex shipped to the East Helena lead smelter 59 tons of gold-silver ore from the East Mint property.

Big Foot and State Creek district.—Ed Lahey worked the Big Four dump in 1945 and shipped 293 tons of lead ore to the East Helena lead smelter. The Blue Jay mine produced the remainder of the district output (34 tons of zinc-lead ore), which was treated at the Midvale, Utah, concentrator and 7 tons of zinc-lead ore shipped to the East Helena lead smelter.

Boulder and Little Boulder district.—The entire output of the Boulder and Little Boulder district comprised 63 tons of silver ore from the Baltimore mine and 30 tons of old gold-silver tailings from the Golden Thread claim, all shipped to the East Helena smelter.

Cataract district.—The Golden Messenger Corp. worked the Crystal mine in 1945 and shipped 631 tons of gold-silver ore to the East Helena lead smelter. From the Morning Glory mine J. K. Curtiss shipped to the Anaconda copper smelter 235 tons of silver ore containing 39 ounces of gold and 5,975 ounces of silver. The remainder of the district output was mainly siliceous ore shipped to smelters from the Queen of the Hills, Jupiter, Shoo Fly, Sirius, Comet, and Bullion properties; in addition, gold ore produced from the Gray Lead mine was amalgamated, and zinc-lead ore from the Aurora mine was treated at the Midvale, Utah, concentrator.

Colorado district.—As in 1944, the leading producer in the Colorado district in 1945 was the Monongahela-Mount Washington Mining Co. operating the Mount Washington mine. Output comprised 694 tons of zinc-lead ore shipped to the East Helena lead smelter and 560 tons of zinc-lead ore treated in the company mill. The resulting 53 tons of zinc concentrate were smelted at Amarillo, Tex., and 19 tons of lead concentrate at the East Helena smelter. Other production from the district included 713 tons of gold-silver ore from the Minah No. 2 dump, 28 tons of lead ore from the Enterprise claim, and 2 tons of zinc-lead ore from Corbett and Ida May claims (all shipped to the East Helena lead smelter) and 21 tons of gold-silver ore from the Blue Bird group.

Elkhorn district.—The bulk of the production from the Elkhorn district in 1945 came from the Elkhorn property. The output (17,471 tons of dump silver ore and 206 tons of crude silver mine ore) was shipped to the East Helena smelter. Francis Wickham worked the Elkhorn Queen mine and sent 507 tons of lead ore to the East Helena smelter. From the Klondyke mine Taylor & Lewis shipped 377 tons of gold ore to the Anaconda copper smelter. Remaining production from the district was negligible.

Montana City district.—Total output of the Montana City district was 16 tons of gold ore shipped to the East Helena smelter from the Last Chance mine.

Whitehall district.—The Golden Sunlight mine, operated by Marvin F. Riebhoff, was one of the most important gold-producing mines in Montana in 1945. The property produced 12,339 tons of gold ore, which was shipped to the Anaconda copper smelter. Ralph Huckaba and Lester Lindquist worked the Carbonate mine and shipped to the East Helena smelter 599 tons of lead ore containing 16 ounces of gold, 1,526 ounces of silver, 331 pounds of copper, 190,178 pounds of lead, and 17,899 pounds of zinc. Gold ore (560 tons) was sent to the East Helena smelter from the Lucky Hit mine; the gross metal content was 279 ounces of gold, 768 ounces of silver, 3,369 pounds of copper, 29,156 pounds of lead, and 23,823 pounds of zinc. From the Minerva mine Theodore Davenport shipped 513 tons of lead ore to the East Helena smelter. Remaining production from the district was lead ore consigned to the East Helena smelter from the Perhaps, Surprise, and Inspiration properties and a car of gold ore shipped from the Midas mine to the Anaconda smelter.

Wilson and Ticer Creeks district.—Gold ore (287 tons) from the Deer Horn Nos. 1, 2, and 3 claims was treated by amalgamation and concentration.

JUDITH BASIN COUNTY

Barker district.—During 1945, 67 tons of zinc-lead ore containing 2 ounces of gold, 2,925 ounces of silver, 874 pounds of copper, 41,331 pounds of lead, and 19,990 pounds of zinc were shipped to the East Helena smelter from the Wright-Edwards group.

Yogo district.—Walter Lehman worked the Gold Bug mine in 1945 and sent to the Anaconda copper smelter 40 tons of gold ore containing 21 ounces of gold, 147 ounces of silver, and 879 pounds of copper. The Blue Dick mine and 50-ton concentration mill were operated from June to October; the milling of about 600 tons of gold-copper ore yielded 38 tons of copper concentrate.

LEWIS AND CLARK COUNTY

Blue Cloud district.—Production from the Blue Cloud district in 1945 comprised 33 tons of gold ore from the Pearl claim and 7 tons of zinc-lead ore from the Lincoln property.

Heddleston district.—The Mike Horse mine, one of the leading producers of lead and zinc in the State in 1945, was worked the first 6 months of the year by the Mike Horse Mining & Milling Co. and the latter 6 months by the American Smelting & Refining Co., after purchase July 1. The 250-ton flotation mill on the property treated a total of 68,581 tons of zinc-lead ore, which yielded 5,634 tons of lead concentrate and 3,030 tons of zinc concentrate. Development at the mine during the year totaled 1,613 feet of drifts. Other production from the district was 2,500 tons of zinc-lead ore from the Carbonate mine treated in the 75-ton flotation mill on the property; 231 tons of zinc-lead concentrate containing 15 ounces of gold, 3,977 ounces of silver, 15,108 pounds of copper, 175,430 pounds of lead, and 51,150 pounds of zinc were recovered.

Helena district.—In July Porter Bros. Corp. resumed operations with its 6-cubic foot Yuba dredge on Last Chance Gulch, after idleness since August 1943. The dredge washed 719,646 cubic yards of gravel. Lode production from the district was very small.

Marysville district.—The Empire group was operated by Mines Operating Co. in 1945, and 8,199 tons of lead ore were treated to recover 359 tons of lead concentrate; 1 ton of lead ore went direct to a smelter. Output of the Drumlummon mine, operated by the Montana Rainbow Mining Co., was 660 tons of gold ore—484 tons went to the East Helena smelter, and 176 tons were treated by amalgamation and concentration. The Belmont mine produced 401 tons of gold ore shipped to smelters; gross-metal content was 264 ounces of gold and 463 ounces of silver. Remaining production from the district was 33 tons of gold ore sent to the East Helena smelter from the Penobscot mine.

Rimini district.—The Anna May & Broadway group was operated under lease in 1945 by the Armstrong Mining Syndicate. The company erected a new flotation mill during the year and treated 2,320 tons of low-grade gold-silver-lead ore. In addition, 206 tons of lead ore were shipped to a smelter. Zinc-lead ore (277 tons) was shipped direct to a smelter from the Red Mountain Consolidated Mining Co. group of claims. Remaining district production was small consignments of gold-silver ore from the Copper Dyke mine and the Lee Mountain dump to the East Helena smelter.

Smelter district.—In 1945 the Smelter district was outranked only by the Summit Valley (Butte) district as a State zinc producer. As in previous years, the bulk of production came from operations of the Anaconda slag-fuming plant at East Helena. Although hot slag and cold slag treated at the plant totaled 197,244 tons in 1945 compared with 233,948 tons in 1944, only the metals recovered from fuming 25,711 tons of old cold lead smelter slag are credited to the plant as a producer in the Smelter district. The remaining metals, after elimination of materials from foreign sources, are credited to the individual domestic mines producing the ores and concentrates that yielded the current hot slag treated in the slag-fuming plant. The American Smelting & Refining Co. resmelted 651 tons of old zinc slag during the year.

LINCOLN COUNTY

Libby district.—The Standard Silver Lead Mining Co. operated its 40-ton flotation mill from May 15 to November 1; about 4,000 tons of old tailings from the Snowshoe group were treated to recover 73 tons of zinc concentrate and 66 tons of zinc-lead concentrate. The Liberty and Hard Times placer claims were worked during the summer and produced 7 ounces of gold.

West Fisher Creek district.—Total production of the West Fisher Creek district in 1945 was 15 tons of gold ore amalgamated—10 tons from the Midas group and 5 tons from the Merrill claim.

MADISON COUNTY

McCarthy Mountain district.—Herman Mueller worked the Polly Jane mine in 1945 and shipped 150 tons of lead ore to the East Helena smelter.

Norris and Norwegian district.—K. W. Leavitt amalgamated about 400 tons of dump material from the Revenue mine. The Boaz mine was operated under lease from January to August and then was sold to A. J. Theis, who operated it the rest of the year. Output was 93 tons of gold ore shipped to the East Helena smelter; metal content was 200 ounces of gold, 107 ounces of silver, 3,666 pounds of lead, and 1,674 pounds of zinc. Remaining district output was gold ore from the Santa Christo, Revenue, and Galena claims and gold-silver ore from the Bettle mine, all shipped to smelters.

Rochester district.—The Calvin group produced 57 tons of zinc-lead ore which was shipped to the Tooele, Utah, lead smelter; 50 tons of similar ore from the Emma group were treated at the Midvale, Utah, concentrator; and from the Copper Sage claim Ted J. Farrow trucked a load of copper ore to the Anaconda copper smelter.

Sheridan district.—The Victoria Mines, Inc., operated its Toledo-Buckeye group and 125-ton flotation mill throughout the year; 31,467 tons of zinc-lead ore were treated, yielding 609 tons of lead concentrate and 1,637 tons of zinc concentrate. From the Dictator & Bell Union group Bell and Bukvich shipped 237 tons of gold ore to the Anaconda smelter. C. Becker Hoskins and Clifford Hyndman worked the Silver Bullion group under lease and shipped to the Anaconda smelter 179 tons of silver ore containing 3 ounces of gold and 2,595 ounces of silver. The rest of the district output was 29 ounces of placer gold recovered from small-scale hand operations.

Silver Star district.—Gold ore (126 tons) was shipped to smelters from the Stella mine.

Tidal Wave district.—Shipments of 225 tons of gold ore and 46 tons of lead ore were made to smelters from the High Ridge and High Ridge Fraction claims. The rest of the district output comprised 74 tons of gold ore from the Corncracker mine, 34 tons of copper ore from the Moffet group, and 8 tons of lead ore from the Dutchland claim, all shipped to smelters.

Virginia City district.—The U. S. Grant Mining Co. operated its U. S. Grant mine throughout 1945; 7,253 tons of gold ore shipped to the Anaconda copper smelter contained 1,140 ounces of gold and 85,778 ounces of silver. In September Ralph E. Davis resumed dragline dredging at the Barton Gulch placer and during the rest of the year washed 29,300 cubic yards of gravel. Remaining district lode production was 43 tons of gold-silver ore sent to the Anaconda smelter from the Eureka claim.

Washington district.—Total output of the Washington district in 1945 was 10 tons of gold ore shipped to a smelter from the Snowslide mine.

MINERAL COUNTY

Keystone district.—E. G. Smith worked the Nancy Lee group in 1945 and mined 1,811 tons of lead ore that was treated in the 100-ton flotation mill constructed on the property during the year. The resulting 40 tons of lead concentrate contained 1 ounce of gold, 990 ounces of silver, 1,466 pounds of copper, 49,224 pounds of lead, and 4,280 pounds of zinc.

Packer Creek district.—The Hecla Mining Co. operated the Silver Cable mine under lease in 1945 and hauled 2,725 tons of zinc-lead ore to its mill at Burke, Idaho. Concentrates produced comprised 487 tons of zinc concentrate and 94 tons of zinc-lead concentrate. The company reported that all available ore was exhausted during the fall, and the lease was terminated.

MISSOULA COUNTY

Coloma district.—The only output in the Coloma district in 1945 was 44 tons of gold ore shipped to the East Helena smelter from the Mammoth group.

Copper Cliff district.—The Blue Bell mine had an output in 1945 of 45 tons of copper ore, 30 tons of silver ore, and 10 tons of lead ore, all shipped to smelters.

Nine Mile district.—Hand placering recovered 10 ounces of gold in 1945.

PARK COUNTY

New World district.—McLaren Gold Mines Co. treated 3,318 tons of copper ore from the Estelle mine in the company 100-ton flotation mill; it yielded 150 tons of copper concentrate containing 606 ounces of gold, 797 ounces of silver, and 42,768 pounds of copper. The Irma mine produced 1,147 tons of zinc-lead ore during the year; 77 tons were shipped to a smelter, and 1,070 tons of mill ore yielded 99 tons of lead concentrate and 115 tons of zinc concentrate. Other district production was 41 tons of ore shipped to a smelter from the Black Warrior mine, containing 27 ounces of gold, 611 ounces of silver, 92 pounds of copper, and 14,168 pounds of lead.

Sheepeater district.—The Jardine Mining Co. worked the Jardine mine 11 months in 1945 and treated 45,217 tons of gold ore in the company combination flotation-cyanidation-amalgamation mill. The bullion yielded 7,747 ounces of gold and 1,592 ounces of silver, and the 81 tons of concentrate yielded 65 ounces of gold and 28 ounces of silver.

PHILLIPS COUNTY

Little Rockies district.—High-grade gold ore (12 tons) was shipped to a smelter from the Little Ben mine.

POWELL COUNTY

Finn district.—Ray W. Crumb and Dan Pyper operated a washing plant at the Peacock placer in Madison Gulch from August to October and recovered 30 ounces of gold from 3,000 cubic yards of gravel.

Nigger Hill district.—From the Charter Oak mine Hopkins & Sons Mining Co. shipped 19 tons of lead ore to a smelter and treated 385 tons of zinc-lead ore in the company 40-ton flotation mill; the mill ore yielded 10 tons of zinc concentrate and 16 tons of zinc-lead concentrate. Remaining district lode output comprised 5 tons of lead ore and 17 tons of zinc-lead ore from the Flora Best group, 42 tons of zinc-lead ore from the Sunset group, and 2 tons of lead ore from the Pauper claim. R. Milleand recovered a little gold by hand placering.

Pioneer district.—Kenneth Davis operated a dragline dredge on Gold Creek for 3 weeks.

Zozell district.—John B. White, Jr., constructed a 100-ton mill at the Emery group and made test runs on gold-silver ore. It is expected that the mine and mill will operate regularly in 1946.

RAVALLI COUNTY

Curlew district.—Hamilton-Victor Mining & Milling Co. operated the Curlew mine throughout 1945 and the 70-ton flotation mill from April 16 to the end of the year. Zinc ore (4,050 tons) was treated to recover 51 tons of lead concentrate and 244 tons of zinc concentrate.

SANDERS COUNTY

Camas Prairie district.—Laurence G. Howard operated the Glaucus mine in 1945 and shipped to the Anaconda smelter 345 tons of copper ore containing 5 ounces of gold, 585 ounces of silver, and 26,575 pounds of copper.

Eagle district.—The Jack Waite mine was operated throughout the year by the American Smelting & Refining Co. Of the output (4,690 tons), 136 tons of lead ore containing 1 ounce of gold, 870 ounces of silver, 90 pounds of copper, 201,565 pounds of lead, and 16,153 pounds of zinc were shipped to a smelter, and 4,554 tons of zinc-lead ore were treated in the company 400-ton flotation mill at Duthie, Idaho. The resulting 675 tons of lead concentrate and 154 tons of zinc concentrate contained 8 ounces of gold, 4,710 ounces of silver, 13,343 pounds of copper, 1,015,385 pounds of lead, and 207,700 pounds of zinc.

Revais Creek district.—The Drake group was operated under lease by the Green Mountain Mining Co. and produced 412 tons of copper ore during the year.

SILVER BOW COUNTY

Ore production in Silver Bow County declined nearly 17 percent from that in 1944, resulting in decreases of 19 percent in gold output, 17 percent in silver, 25 percent in copper, and 13 percent in lead; zinc, however, gained 5 percent. The slight increase in zinc production and the slightly higher average prices for lead and zinc failed to offset the loss in value of metals produced, and the total value of the five metals was the lowest since 1939, representing a decrease of 22 percent from that in 1944. The following table gives the output of mines in Silver Bow County, which includes the Summit Valley (Butte) district, in 1944 and 1945 and the total from 1882 to the end of 1945.

Production of gold, silver, copper, lead, and zinc in Silver Bow County, Mont., 1944–45, and total, 1882–1945, in terms of recovered metals

Year	Mines producing	Ore (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1944	27	5,429,931	15,463	6,001,695	234,732,200	6,395,000	16,173,500	$38,877,303
1945	24	4,528,282	12,484	4,976,910	175,899,200	5,551,500	16,986,400	30,179,133
1882–1945	-------	(1)	2,019,271	543,367,010	[2] 6,485,914	[2] 232,505	[2] 1,563,661	2,576,206,695

[1] Figures not available.

[2] Short tons.

Summit Valley (Butte) district.—The aggregate tonnage of copper-mine ore, dumps, waste tailings, and slimes treated by the Anaconda Copper Mining Co. in 1945 declined 17 percent from that in 1944. The copper concentrator at Anaconda treated 1,747,946 tons of copper ore from company-owned Butte mines compared with 2,362,041 tons in 1944, and 4,114 tons of copper mine-water precipitates were treated compared with 3,706 tons in 1944. Additional material treated in the concentrator comprised 591,914 tons of New Works sand tailings compared with 1,387,782 tons in 1944; 905,001 tons of Butte tailings compared with none in 1944; 424,684 tons of mine dumps compared with 752,571 tons in 1944; 64,375 tons of special waste compared with 125,372 tons in 1944; and no Old Works tailings compared with 4,364 tons in 1944. Direct smelting material comprised 43,522 tons of crude ore, 410 tons of special waste, and 14,517 tons of Old Works tailings.

Slimes treated at the slime-disintegrating plant were as follows (1944 figures in parenthesis): Butte slimes, 264,385 tons (279,007 tons of Butte and Boston slimes); 283,831 tons of New Works Valley Pond slimes (207,133 tons); and no Old Works slimes (13,816 tons). The 548,216 tons of slimes treated in 1945 averaged 1.73 percent copper compared with 514,480 tons treated in 1944, which averaged 2.36 percent copper.

The Anaconda Copper Mining Co. operated the North Butte group throughout the year under contract. Output was slightly greater than in 1944 and comprised 133,032 tons of copper mill ore, 39 tons of copper smelting ore, and 104 tons of copper mine-water precipitates. Zinc ore mined from all company zinc mines totaled 3,712 tons in 1945. Anaconda continued operating the Emma mine under lease and produced 20,337 tons of zinc-lead middlings from the treatment of manganese ore. In addition, 5,692 tons of zinc-lead middlings were produced in milling manganese ore from the Orphan Girl and Travona mines; the middlings were treated further at the Anaconda zinc concentrator.

Lessees of the Anaconda Copper Mining Co. operated a number of properties at Butte during the year and produced 27,803 tons of ore, of which 15,016 tons (zinc ore) came from the Poulin mine. The remainder of the district output was mainly 4,033 tons of material (containing chiefly silver, lead, and zinc) shipped to a smelter from the Alloy dump.

German Gulch district.—Hand placering recovered 10 ounces of gold from the Beal Hill claim.

Smelter district.—The Domestic Manganese & Development Co. treated manganese ore from several mines in the vicinity and produced 1,750 tons of zinc-lead middlings, which were separated into 569 tons of lead concentrate and 192 tons of zinc concentrate.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEVADA

(MINE REPORT)

By Alfred L. Ransome and Burton H. Marliave

SUMMARY OUTLINE

SUMMARY

Production of zinc in Nevada in 1945 was the largest, both in quantity and value, in the history of the State, surpassing the previous record of 1944 by 4 percent in quantity and 5 percent in value. Gold output, on the other hand, was 23 percent below the total for 1944 and was the lowest in quantity since 1895. Silver production fell 17 percent to the lowest level since 1899. The total value of gold, silver, copper, lead, and zinc recovered from ore, old tailings, and gravels in Nevada in 1945 was $24,186,294 compared with $27,371,513 in 1944, a decline of 12 percent, owing to smaller outputs of gold, silver, copper, and lead. Rising costs of labor, supplies, and equipment, the difficulty of obtaining them, and the fixed prices for gold and silver were factors in reducing output. An expected increase in production of gold following the rescinding of War Production Board Limitation Order L-208 on July 1, 1945, did not materialize, except at placer mines.

Comparing 1945 with 1944, gold output decreased 23 percent, silver 17 percent, and copper 14 percent in both quantity and value; lead decreased 5 percent in quantity but increased 2 percent in value; and zinc increased 4 percent in quantity and 5 percent in value. Of the total value of the five metals, copper comprised 59 percent, zinc over 20 percent, gold over 13 percent, lead over 4 percent, and silver 3 percent.

White Pine County continued its lead over the other counties by producing 64 percent of the State total value of the five metals; it stood first in output of copper and gold, second in silver, third in zinc, and fourth in lead. Lincoln County produced 20 percent of the State total value and ranked second to White Pine County; it led the State in output of zinc, lead, and silver.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are "bank measure"; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Nevada, 1941–45, and total, 1859–1945, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	799	78	8,799,635	366,403	$12,824,105	5,830,238	$4,145,947
1942	434	49	9,383,379	295,112	10,328,920	3,723,435	2,647,776
1943	168	17	8,364,043	144,442	5,055,470	1,620,280	1,152,199
1944	146	11	6,863,505	119,056	4,166,960	1,259,636	895,741
1945	163	12	5,374,673	92,265	3,229,275	1,043,380	741,959
1859–1945 [2]			(3)	25,426,321	568,482,911	588,353,061	539,716,076

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	157,822,000	$18,622,996	19,246,000	$1,097,022	30,258,000	$2,269,350	$38,959,420
1942	167,326,000	20,246,446	10,752,000	720,384	20,394,000	1,896,642	35,840,168
1943	142,136,000	18,477,680	9,580,000	718,500	27,294,000	2,947,752	28,351,601
1944	122,464,000	16,532,640	13,210,000	1,056,800	41,398,000	4,719,372	27,371,513
1945	105,190,000	14,200,650	12,550,000	1,079,300	42,914,000	4,935,110	24,186,294
1859–1945 [2]	[4] 1,734,052	489,951,938	[4] 540,005	58,683,367	[4] 324,839	49,962,160	1,706,796,452

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Data for years 1859–1944 compiled by Chas. W. Henderson, Bureau of Mines. From 1904 (when first satisfactory annual canvass of mine production was made) to 1945, inclusive, the output was as follows: Gold, 13,599,444.51 ounces valued at $323,999,678; silver, 299,940,212 ounces, $202,557,853; copper, 1,732,126 tons, $489,305,310; lead, 302,214 tons, $36,046,805; zinc, 324,839 tons, $49,962,160; total value, $1,101,871,806.
[3] Figures not available.
[4] Short tons.

Gold.—Gold production in Nevada in 1945, decreasing 23 percent from the 1944 output, was the lowest in quantity since 1895 and in value since 1933. The only appreciable effect on gold production of the termination of WPB Limitation Order L–208 was an increase of 30 percent in the gold produced by placer-mining methods in 1945 compared with 1944. The monthly production figures shown in the accompanying table indicate no sharp increase in the latter half of the year following the rescinding of Order L–208, but rather a general decline followed by a trend upward during the last 2 months of the year. The December total (8,661 ounces) was short of the general level attained during the first 6 months. Byproduct gold from base-metal ores comprised 59 percent of the output of gold, again exceeding the gold recovered from precious metal ores, which was 31 percent of the total.

The 10 leading gold-producing mines in 1945 produced 93 percent of Nevada's output, the three leaders contributing 60 percent.

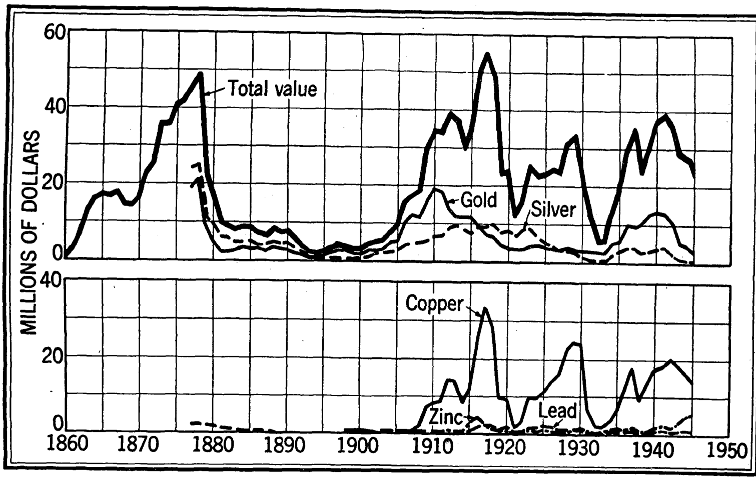

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc and total value in Nevada, 1860–1945.

Ten leading gold-producing mines in Nevada in 1945, in order of output

Rank	Mine	District	County	Rank in 1944	Operator	Source of gold
1	Ruth and Copper Flat Pit.	Robinson	White Pine	2	Kennecott Copper Corp. (Nevada Mines Division).	Copper ore.
2	Coppermines group	do	do	3	Consolidated Coppermines Corp.	Do.
3	Getchell	Potosi	Humboldt	1	Getchell Mine, Inc.	Gold ore.
4	Manhattan dredge	Manhattan	Nye	5	Manhattan Gold Dredging Co.	Dredge.
5	Goldacres	Bullion	Lander	4	Willow Creek Mines, Inc.	Gold ore.
6	Copper Canyon	BattleMountain.	do	6	Copper Canyon Mining Co.	Copper ore.
7	Divide	Divide	Esmeralda	12	Tonopah Divide Mining Co.	Gold ore.
8	Pioche group	Pioche	Lincoln	7	Combined Metals Reduction Co.	Zinc-lead ore.
9	Blossom	Searchlight	Clark	(1)	Golden Dawn Mining and Milling Co.	Gold ore.
10	Tonopah Mining Co.	Tonopah	Nye	10	Various lessees	Gold-silver ore

[1] Did not produce in 1944.

Silver.—The 10 leading silver-producing mines in Nevada in 1945 produced 71 percent of the State total recoverable silver, the first 2 yielding 32 percent of the total. As in preceding years, most of the silver was a byproduct of ore mined chiefly for other metals;

only 5 percent of the silver was derived from straight silver ore. Base-metal ores were the source of 84 percent of the State's silver output in 1945. The monthly production figures in the accompanying table show a fluctuating output during 1945, with no definite trend.

Ten leading silver-producing mines in Nevada in 1945, in order of output

Rank	Mine	District	County	Rank in 1944	Operator	Source of silver
1	Pioche group	Pioche	Lincoln	1	Combined Metals Reduction Co.	Zinc-lead ore.
2	Ruth and Copper Flat Pit.	Robinson	White Pine	2	Kennecott Copper Corp. (Nevada Mines Division).	Copper ore.
3	Cleveland	Delano	Elko	14	McFarland & Hullinger	Silver ore and lead ore.
4	Coppermines group	Robinson	White Pine	7	Consolidated Coppermines Corp.	Copper ore.
5	Copper Canyon	Battle Mountain.	Lander	3	Copper Canyon Mining Co.	Do.
6	Prince	Pioche	Lincoln	6	Prince Consolidated Mining Co.	Zinc ore, silver ore, and lead ore.
7	Financier	do	do	8	Salt Lake-Pioche Mining Co. and lessees.	Lead ore.
8	Bristol Silver	Jack Rabbit	do	5	Bristol Silver Mines Co.	Copper ore and zinc ore.
9	Tonopah Mining Co.	Tonopah	Nye	4	Tonopah Mining Co. of Nevada.	Gold-silver ore.
10	Ely Valley	Pioche	Lincoln	12	Ely Valley Mine	Zinc ore.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1945, by months, in terms of recovered metals

Month	Gold	Silver	Copper	Lead	Zinc
	Fine ounces	*Fine ounces*	*Short tons*	*Short tons*	*Short tons*
January	9,250	92,177	4,702	451	2,097
February	9,352	75,696	4,062	451	1,593
March	9,188	81,675	4,166	414	1,392
April	7,532	81,184	4,035	335	1,788
May	8,750	105,614	5,154	544	1,929
June	7,324	73,024	4,951	432	1,740
July	5,344	82,709	3,049	622	1,104
August	7,406	82,247	4,826	472	1,628
September	6,584	74,378	4,002	547	1,611
October	5,722	95,189	4,490	657	2,343
November	7,152	94,208	4,336	711	2,298
December	8,661	105,279	4,822	639	1,934
	92,265	1,043,380	52,595	6,275	21,457

Copper.—Of the recoverable copper output of Nevada in 1945, 97 percent came from the three leading producers: The Kennecott Copper Corp. (Nevada Mines Division), working the Ruth mine and the open-pit mine at Copper Flat (both in the Robinson district, White Pine County); the Consolidated Coppermines Corp., working the Coppermines group at Kimberly (also in the Robinson district); and the Mountain City Copper Co., working the Mountain City mine at Mountain City (in the Cope district, Elko County). During 1945 the Kennecott Copper Corp. did extensive preparatory stripping of overburden in extending its pit to mine ore belonging to the Consolidated Coppermines Corp. by mutual agreement of both companies. The monthly production of copper from Nevada remained fairly constant throughout the year.

Lead.—The Pioche district, Lincoln County, supplied 48 percent of the lead produced in Nevada during 1945; the leading lead properties were: The Pioche group operated by the Combined Metals Reduction Co., the Ely Valley mine operated by Ely Valley Mine, the Prince mine operated by the Prince Consolidated Mining Co., and the Financier mine operated by the Salt Lake-Pioche Mining Co. and lessees. Other important producers in the State were: The Nevada Lead & Zinc Co., Nevada Lead mine (Spruce Mountain district, Elko County); McFarland & Hullinger and others, Cleveland mine (Delano district, Elko County); the International Mining Corp., Groom mine (Groom district, Lincoln County); and the Bristol Silver Mines Co., Bristol Silver mine (Jack Rabbit district, Lincoln County). The State total production of lead showed a general upward trend during the second half of 1945; the data by months are given in the accompanying table.

Zinc.—In 1945, as in recent years, zinc production in Nevada was centered in the Pioche district, Lincoln County, where 77 percent of the State total for the year was mined. The Combined Metals Reduction Co. (including the Raymond Ely West mine), Ely Valley Mine, and Prince Consolidated Mining Co. were the State's leading producers, in that order; all were in the Pioche district. Other important producers in the State were: Callahan Zinc-Lead Co., Mount Hope mine (Eureka district, Eureka County); Grand Deposit Mining Co., Grand Deposit and Kansas mines (Aurum district, White Pine County); Union Lead Mining & Smelting Co., Union Lode mine (Galena district, Washoe County); Nevada Lead & Zinc Co., Nevada Lead mine (Spruce Mountain district, Elko County); and Sam Robison, Columbia mine (Robinson district, White Pine County). The monthly State total production figures given in the accompanying table show a fluctuating output during the year. Output was highest in October, followed by a gradual decline during November and December.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1945, by counties, in terms of recovered metals

County	Mines producing[1]		Gold						Silver (lode and placer)	
	Lode	Placer	Lode		Placer		Total			
			Fine ounces	Value	Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Churchill	5		125	$4, 375			125	$4, 375	3, 330	$2, 368
Clark	15		893	31, 255			893	31, 255	41, 632	29, 605
Elko	16	(2)	530	18, 550	2	$70	532	18, 620	114, 743	81, 595
Esmeralda	8		2, 864	100, 240			2, 864	100, 240	13, 164	9, 361
Eureka	3	1	33	1, 155	7	245	40	1, 400	16, 380	11, 648
Humboldt	10		11, 244	393, 540			11, 244	393, 540	2, 506	1, 782
Lander	12		15, 857	554, 995			15, 857	554, 995	75, 413	53, 627
Lincoln	13		2, 601	91, 035			2, 601	91, 035	409, 867	291, 461
Lyon	10	(2)	105	3, 675	9	315	114	3, 990	1, 879	1, 336
Mineral	13		237	8, 295			237	8, 295	34, 529	24, 554
Nye	21	5	1, 255	43, 925	9, 517	333, 095	10, 772	377, 020	81, 564	58, 001
Ormsby	2		77	2, 695			77	2, 695	24	17
Pershing	11	4	355	12, 425	16	560	371	12, 985	12, 081	8, 591
Storey	4	1	656	22, 960	5	175	661	23, 135	4, 646	3, 304
Washoe	5		130	4, 550			130	4, 550	21, 818	15, 515
White Pine	15	1	45, 743	1, 601, 005	4	140	45, 747	1, 601, 145	209, 804	149, 194
	163	12	82, 705	2, 894, 675	9, 560	334, 600	92, 265	3, 229, 275	1, 043, 380	741, 959
Total, 1944	146	11	111, 703	3, 909, 605	7, 353	257, 355	119, 056	4, 166, 960	1, 259, 636	895, 741

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Churchill			62, 000	$5, 332			$12, 075
Clark	30, 000	$4, 050	1, 040, 000	89, 440	1, 750, 000	$201, 250	355, 600
Elko	4, 654, 000	628, 290	2, 372, 000	203, 992	1, 482, 000	170, 430	1, 102, 927
Esmeralda			2, 000	172			109, 773
Eureka	12, 000	1, 620	156, 000	13, 416	2, 408, 000	276, 920	305, 004
Humboldt			4, 000	344			395, 666
Lander	1, 158, 000	156, 330	72, 000	6, 192	40, 000	4, 600	775, 744
Lincoln	202, 000	27, 270	7, 004, 000	602, 344	33, 656, 000	3, 870, 440	4, 882, 550
Lyon	368, 000	49, 680					55, 006
Mineral	58, 000	7, 830	406, 000	34, 916	150, 000	17, 250	92, 845
Nye	16, 000	2, 160	476, 000	40, 936			478, 117
Ormsby							2, 712
Pershing	152, 000	20, 520	66, 000	5, 676			47, 772
Storey							26, 439
Washoe	32, 000	4, 320	332, 000	28, 552	1, 062, 000	122, 130	175, 067
White Pine	98, 508, 000	13, 298, 580	558, 000	47, 988	2, 366, 000	272, 090	15, 368, 997
	105, 190, 000	14, 200, 650	12, 550, 000	1, 079, 300	42, 914, 000	4, 935, 110	24, 186, 294
Total, 1944	122, 464, 000	16, 532, 640	13, 210, 000	1, 056, 800	41, 398, 000	4, 719, 372	27, 371, 513

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Output from property not classed as a "mine."

MINING INDUSTRY

The 22-percent decline in total tonnage of ores and old tailings sold or treated in Nevada in 1945 compared with 1944 reflects a decline in all ores except zinc-lead and silver ores. The decrease in production, which was general throughout the industry, resulted from increasing costs after the war ended, with no proportionate increase in gross income and a continued shortage of labor.

The connected-bucket dredge of the Manhattan Gold Dredging Co. in the Manhattan district, Nye County, was again the largest producer of placer gold and fourth-largest producer of total gold in the State. Except for this operation, Nevada placer mines were limited almost entirely to small-scale hand operations.

ORE CLASSIFICATION

The following table classifying ores sold or treated in Nevada in 1945 shows that 92 percent of the tonnage (including old tailings) was copper ore, 3 percent zinc-lead ore and old tailings, 3 percent gold ore and old tailings, and the remainder zinc ore and gold-silver, silver, and lead ore and old tailings.

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Nevada in 1945, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	183,002	300	27,172	28,595	1,200	5,900	
Dry and siliceous gold-silver ore	11,073	220	1,103	74,932	327,100	134,100	
Dry and siliceous silver ore	1,755	6,417	178	57,177	43,200	491,600	
	195,830	6,937	28,453	160,704	371,500	631,600	
Copper ore	4,917,945		51,340	270,607	[1] 104,406,100	18,700	
Lead ore	9,286	3,421	287	167,075	39,500	2,761,800	101,800
Zinc ore	94,029		441	101,027	234,500	1,659,600	17,343,200
Zinc-lead ore	143,423	3,802	2,184	340,156	138,400	7,478,300	25,469,000
Total, lode mines	5,360,513	14,160	82,705	1,039,569	[1] 105,190,000	12,550,000	42,914,000
Total, placers			9,560	3,811			
	5,360,513	14,160	92,265	1,043,380	[1] 105,190,000	12,550,000	42,914,000
Total, 1944	6,858,628	4,877	119,056	1,259,636	[2] 122,464,000	13,210,000	41,398,000

[1] Includes 4,459,300 pounds of copper from precipitates.
[2] Includes 9,245,700 pounds of copper from precipitates.

METALLURGIC INDUSTRY

Of the 5,374,673 tons of lode material from Nevada mines sold or treated during 1945, 94 percent went to concentrating mills, 3 percent to amalgamation and cyanidation mills, and 3 percent to smelters; of the total, 0.26 percent was old tailings, all cyanided or smelted. Flotation was employed to the exclusion of gravity methods at concentration mills, with the exception of a small production at three plants. Of the gold recovered as bullion, cyanidation supplied 95 percent and amalgamation 5 percent; of the silver recovered as bullion, 89 percent was derived by cyanidation and 11 percent by amalgamation. The tonnage of crude ore and old tailings shipped to smelters decreased 15 percent compared with 1944.

Insufficient information as to cyanide and quicksilver consumption precludes publishing figures on this phase of the industry.

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The 500-ton selective-flotation mill operated by the Combined Metals Reduction Co. at Pioche, Lincoln County, treated zinc-lead and zinc ores on a custom basis for several neighboring mines and also

Mine production of metals in Nevada in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	5,338	1,076	564			
Ore and old tailings cyanided	173,540	19,713	4,757			
Concentrates smelted:						
Flotation	241,572	52,795	584,248	94,219,100	6,248,300	36,699,200
Gravity	338	145	7,149	700	177,300	63,100
Ore and old tailings smelted	148,824	8,976	442,851	6,510,900	6,124,400	6,151,700
Precipitates smelted				4,459,300		
Total, lode mines		82,705	1,039,569	105,190,000	12,550,000	42,914,000
Total, placers		9,560	3,811			
		92,265	1,043,380	105,190,000	12,550,000	42,914,000
Total, 1944		119,056	1,259,636	122,464,000	13,210,000	41,398,000

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Nevada in 1945, by types of mills and by counties, in terms of recovered metals

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal					
	Ore [1]	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
AMALGAMATION MILLS										
Churchill	35		8	4						
Clark	2		1	1						
Humboldt	517		386	190						
Lander	349		181	31						
Lyon	2,400		14	9	10	48	288			
Nye	300		148	92						
Ormsby	1,250		43	9	9	34	15			
Pershing	357		238	204	4	61	70			
Washoe	128		57	24						
	5,338		1,076	564	23	143	373			
Total, 1944	1,053		1,131	2,835	9	124	500			
CYANIDATION MILLS										
Humboldt	88,444	300	9,870	1,561						
Lander	83,396		9,391	1,344						
Lyon		220	13	291						
Nye	100		25	10						
Storey	1,080		414	1,551						
	173,020	520	19,713	4,757						
Total, 1944	410,005	260	47,187	44,152	456	1,211	3,683	51,000	2,000	
Grand total:										
1945	178,358	520	20,789	5,321	23	143	373			
1944	411,058	260	48,318	46,987	465	1,335	4,183	51,000	2,000	

[1] Figures under "Ore" include both raw ore and concentrates amalgamated or cyanided, but not raw ore concentrated before amalgamation or cyanidation of concentrates.

milled company zinc-lead ore. The Kennecott Copper Corp. treated all the copper ore produced by the Consolidated Coppermines Corp., upon a contract basis, in addition to milling its own ore. The Kennecott Copper Corp. also operated the McGill copper smelter, Nevada's only smelter and the most important privately financed metallurgical plant in the State.

Gross metal content of Nevada crude ore and old tailings shipped to smelters in 1945, by classes of material

Class of material	Material treated		Gross metal content				
	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold	4, 724		6, 280	23, 584	2, 125	7, 584	
Dry and siliceous gold-silver	10, 993		1, 063	74, 038	334, 903	162, 400	
Dry and siliceous silver	1, 650	6, 417	178	56, 639	56, 295	531, 621	
Copper	85, 269		1, 005	23, 016	[1] 10, 639, 768	26, 723	
Lead	9, 201	3, 421	287	165, 725	51, 408	2, 884, 452	140, 905
Zinc	17, 894		128	76, 584	275, 769	1, 090, 162	5, 409, 095
Zinc-lead	5, 453	3, 802	35	23, 265	107, 897	1, 687, 875	2, 950, 263
	135, 184	13, 640	8, 976	442, 851	[1] 11, 468, 165	6, 390, 817	8, 500, 263
Total, 1944	169, 471	4, 617	5, 421	503, 214	[2] 19, 721, 563	5, 303, 812	5, 970, 078

[1] Includes 4,652,842 pounds of copper contained in precipitates.
[2] Includes 9,367,856 pounds of copper contained in precipitates.

Mine production of metals from Nevada concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	293	2	4, 888	500	158, 300	63, 100
Elko	13, 226	174	9, 044	3, 408, 000	12, 700	700
Eureka	2, 441	17	16, 205	11, 900	125, 600	2, 226, 900
Lander	6, 298	5, 913	61, 100	655, 800	30, 700	40, 000
Lincoln	37, 753	2, 341	287, 323		5, 597, 400	33, 219, 600
Lyon	10	48	288			
Mineral	461	8	4, 873	1, 800	161, 100	150, 000
Nye	12		538		7, 500	
Ormsby	9	34	15			
Pershing	8	61	281		300	
Washoe	1, 880	72	21, 617	31, 800	332, 000	1, 062, 000
White Pine	179, 519	44, 270	185, 225	90, 110, 000		
	241, 910	52, 940	591, 397	94, 219, 800	6, 425, 600	36, 762, 300
Total, 1944	268, 222	57, 964	706, 531	103, 211, 400	8, 191, 200	37, 042, 800

BY CLASSES OF CONCENTRATES

	Concentrates	Gold	Silver	Copper	Lead	Zinc
Dry gold	23	143	373			
Dry silver	6		500		300	
Copper	198, 919	50, 335	247, 591	94, 172, 900		
Lead	7, 237	1, 476	210, 753	23, 400	5, 501, 800	620, 300
Zinc	35, 432	984	127, 292	23, 000	765, 200	36, 078, 900
Zinc-lead	293	2	4, 888	500	158, 300	63, 100
	241, 910	52, 940	591, 397	94, 219, 800	6, 425, 600	36, 762, 300

Gross metal content of concentrates produced from ores mined in Nevada in 1945, by classes of concentrates

Classes of concentrates	Concentrates produced	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	23	143	373	----------	----------	----------
Dry silver	6	----------	500	17	379	----------
Copper	198,919	50,335	247,591	98,208,375	----------	----------
Lead	7,237	1,476	210,753	34,140	5,614,544	861,352
Zinc	35,432	984	127,292	25,001	831,043	36,913,512
Zinc-lead	293	2	4,888	610	161,054	87,267
	241,910	52,940	591,397	98,268,143	6,607,020	37,862,131
Total, 1944	268,222	57,964	706,531	105,530,197	8,441,046	41,673,954

Mine production of metals from concentrating mills in Nevada in 1945, in terms of recovered metals

BY COUNTIES

	Ore treated	Concentrates smelted and recovered metal					
		Concentrates produced	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Clark	2,190	293	2	4,888	500	158,300	63,100
Elko	34,055	13,226	174	9,044	3,408,000	12,700	700
Eureka	19,243	2,441	17	16,205	11,900	125,600	2,226,900
Lander	48,311	6,298	5,913	61,100	655,800	30,700	40,000
Lincoln	181,983	37,753	2,341	287,323	----------	5,597,400	33,219,600
Mineral	1,858	461	8	4,873	1,800	161,100	150,000
Nye	105	12	----------	538	----------	7,500	----------
Pershing	(1)	4	----------	211	----------	300	----------
Washoe	8,421	1,880	72	21,617	31,800	332,000	1,062,000
White Pine	4,750,805	179,519	44,270	185,225	90,110,000	----------	----------
	5,046,971	241,887	52,797	591,024	94,219,800	6,425,600	36,762,300
Total, 1944	6,278,099	267,757	56,629	702,348	103,160,400	8,189,200	37,042,800

BY CLASSES OF CONCENTRATES

	Concentrates produced	Gold	Silver	Copper	Lead	Zinc
Dry silver	6	----------	500	----------	300	----------
Copper	198,919	50,335	247,591	94,172,900	----------	----------
Lead	7,237	1,476	210,753	23,400	5,501,800	620,300
Zinc	35,432	984	127,292	23,000	765,200	36,078,900
Zinc-lead	293	2	4,888	500	158,300	63,100
	241,887	52,797	591,024	94,219,800	6,425,600	36,762,300

[1] Tungsten ore.

Mine production of metals from Nevada crude ore and old tailings shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Material treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Churchill	605		117	3,326		62,000	
Clark	6,436		890	36,743	29,500	881,700	1,686,900
Elko	16,625	5,083	356	105,699	1,246,000	2,359,300	1,481,300
Esmeralda	2,738		2,864	13,164		2,000	
Eureka	384		16	175	100	30,400	181,100
Humboldt	177		988	755		4,000	
Lander	7,116		372	12,938	502,200	41,300	
Lincoln	10,098		260	122,544	202,000	1,406,600	436,400
Lyon	5,280		30	1,288	368,000		
Mineral	562	3,779	229	29,656	56,200	244,900	
Nye	3,747	3,323	1,082	77,158	16,000	468,500	
Pershing	3,069		56	11,596	152,000	65,700	
Storey	204		242	3,053			
Washoe	18		1	177	200		
White Pine	78,125	1,455	1,473	24,579	[1] 8,398,000	558,000	2,366,000
	135,184	13,640	8,976	442,851	[1] 10,970,200	6,124,400	6,151,700
Total, 1944	169,471	4,617	5,421	503,214	[2] 19,252,600	5,018,800	4,355,200

BY CLASSES OF MATERIAL

	Ore	Old tailings	Gold	Silver	Copper	Lead	Zinc
Dry and siliceous gold	4,724		6,280	23,584	1,200	5,600	
Dry and siliceous gold-silver	10,993		1,063	74,038	327,100	134,100	
Dry and siliceous silver	1,650	6,417	178	56,639	43,200	484,100	
Copper	85,269		1,005	23,016	[1] 10,233,200	18,700	
Lead	9,201	3,421	287	165,725	39,300	2,750,300	101,800
Zinc	17,894		128	76,584	234,500	1,071,700	3,915,200
Zinc-lead	5,453	3,802	35	23,265	91,700	1,659,900	2,134,700
	135,184	13,640	8,976	442,851	[1] 10,970,200	6,124,400	6,151,700

[1] Includes 4,459,300 pounds of copper from precipitates.
[2] Includes 9,245,700 pounds of copper from precipitates.

Mine production of gold, silver, copper, lead, and zinc in Nevada in 1945, by counties and districts in terms of recovered metals [1]

County and District [1]	Mines producing [2] Lode	Mines producing [2] Placer	Ore and old tailings	Gold Lode	Gold Placer	Gold Total	Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
			Short tons	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Churchill County:											
Alpine	1		72	16		16	571		3,800		$1,293
Desert	1		92	22		22	246				945
Fairview	1		383	7		7	1,665		58,200		6,434
Clark County:											
Searchlight	5		401	852		852	5,708	2,000	1,200		34,252
Yellowpine (Goodsprings)	10		8,227	41		41	35,924	28,000	1,038,800	1,750,000	321,348
Elko County:											
Contact (Salmon River)	2		5,344	48		48	3,759	264,000			39,993
Cope (Mountain City)	(4)	(5)	(4)	(4)	2	[6] 2	(4)	(4)			70
Delano	1		2,185	20		20	65,451	13,800	717,000		110,768
Dolly Varden	1		707	4		4	436	57,800			8,253
Jarbidge	1		47	139		139	180				4,993
Loray	1		1,281				8,889	3,000	168,200		21,191
Mardis	1		29	70		70	52	200			2,514
Merrimac	1		85				1,350	200	11,500		1,976
Railroad	1		46	1		1	284	6,000			1,047
Spruce Mountain	6		8,812	36		36	25,366	92,200	1,475,300	1,482,000	329,051
Esmeralda County:											
Divide	1		2,378	2,582		2,582	12,181				99,032
Goldfield	4		95	35		35	287		2,000		1,601
Lone Mountain	1		1	6		6	606				641
Silver Peak	2		264	241		241	90				8,499
Eureka County:											
Eureka	3		19,627	33		33	16,380	12,000	156,000	2,408,000	304,759
Lynn		1			7	7					245
Humboldt County:											
Awakening	4		511	375		375	215				13,278
Barrett Springs	3		329	40		40	10				1,407
Paradise Valley	1		90	75		75	17				2,637
Potosi	1		88,506	10,752		10,752	2,264		4,000		378,274
Lander County:											
Battle Mountain	6		55,046	6,186		6,186	71,903	1,152,000	66,500	28,000	432,100
Kingston	1		29	10		10	7				355
Lewis	1		200				689			12,000	1,870
New Pass	1		320	171		171	24				6,002
Lincoln County:											
Comet	1		323	22		22	1,956		20,000	70,600	12,000
Groom	1		2,194	5		5	8,304	4,000	633,000		61,058
Jack Rabbit	1		5,501	22		22	48,929	195,000	376,000	436,400	144,411
Pahranagat	1		5				419		1,000		384

Pioche	9		184,058	2,552		2,552	350,259	3,000	5,974,000	33,149,000	4,664,697
Lyon County:											
Buckskin		(5)			9	9	3				317
Silver City	3		2,622	81		81	592				3,256
Yerington	7		5,278	24		24	1,284	368,000			51,433
Mineral County:											
Aurora	2		17	3		3	28	2,400			449
Bell	1		19	9		9	166		3,000		691
Columbus (Candelaria)	1		1,507	33		33	10,298	3,200	124,500		19,617
Garfield	1		47	35		35	4,036	200	3,500		4,423
Marietta	1		1				59		800		111
Santa Fe	3		2,171	25		25	5,009	26,000	154,500	142,400	37,610
Silver Star	4		2,437	132		132	14,933	26,200	119,700	7,600	29,944
Nye County:											
Bullfrog	1		19	58		58	3,981	2,200			5,158
Johnnie		1			2	2					70
Mammoth	1		105	38		38	817	200	19,000		3,572
Manhattan	6	4	491	355	9,515	9,870	3,932				348,246
Northumberland	1		1	14		14	24				507
Reveille	1		82				277		8,000		885
Tonopah	4		1,845	596		596	48,434				55,302
Tybo	2		713	21		21	3,195	400	48,500		7,232
Union	3		2,754	21		21	9,713	9,000	223,000		28,035
Ormsby County: Delaware	2		1,250	77		77	24				2,712
Pershing County:											
Aldrich	1		256	1		1	3,735	600	47,700		6,874
Central	1		48	5		5	1,665		5,500		1,832
Jersey	1		69	4		4	990	200	12,500		1,946
Rochester		3			12	12					420
Rosebud	1	1	45	21	4	25	360				1,131
Seven Troughs	1		267	282		282	263				10,057
Sierra	3		226	20		20	1,461				1,739
Storey County: Comstock	4	1	1,284	656	5	661	4,646				26,439
Washoe County:											
Peavine	1		1	1		1	142	200			163
Whitehorse (Olinghouse)	3		128	57		57	24				2,012
White Pine County:											
Aurum (Silver Mountain)	1		7,284	42		42	8,346	153,000	110,000	1,655,600	227,914
Granite	1		9	9		9	3				317
Hunter	1		157				914	3,400	10,000		1,969
Kinsley	1		37				315	1,200	1,800		541
Osceola	3	1	811	629	4	633	256		6,000		22,853
Robinson (Ely)	8		4,822,087	45,063		45,063	199,970	98,350,400	430,200	710,400	15,115,403
Other districts [8]	13		133,417	10,030		10,030	49,064	4,410,000	515,300	1,062,000	1,147,736
Total Nevada	163	12	5,374,673	82,705	9,560	92,265	1,043,380	[7] 105,190,000	12,550,000	42,914,000	24,186,294

[1] Only those districts shown separately for which Bureau of Mines is at liberty to publish figures; other producing districts listed in footnote 8 and their output included under "Other districts."

[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.

[3] Source of total silver as follows: 1,039,569 ounces from lode mines and 3,811 from placers.

[4] Included under "Other districts."

[5] Output from property not classed as a mine.

[6] Exclusive of lode output, which is included under "Other districts."

[7] Includes 4,459,300 pounds of copper precipitates.

[8] Includes following districts: Eastgate in Churchill County; Cope (lode) in Elko County; Gold Run in Humboldt County; Bullion and Hilltop in Lander County; Quartz Mountain in Nye County; Antelope (Majuba) and Nightingale in Pershing County; and Galena in Washoe County.

CHURCHILL COUNTY

Eastgate district.—W. H. Schweis shipped gold ore to a smelter from the Gold Ledge mine during 1945.

Fairview district.—Lowell Thompson shipped lead ore to a smelter from the Chalk Mountain mine during 1945.

CLARK COUNTY

Searchlight district.—The Golden Dawn Mining & Milling Co. shipped gold ore to a smelter from the Blossom mine during 1945; the mine was ninth on the list of the leading gold producers in 1945.

Yellow Pine (*Goodsprings district*).—The Argentena Consolidated Mining Co. worked the Argentena mine throughout 1945; 1,807 tons of zinc ore containing 17 ounces of gold, 9,445 ounces of silver, 3,831 pounds of copper, 123,540 pounds of lead, and 679,045 pounds of zinc were shipped to a smelter. William T. Frazer worked the Hoosier mine from March through August 1945, shipping to a smelter 498 tons of lead ore containing 2 ounces of gold, 1,069 ounces of silver, 258 pounds of copper, 155,977 pounds of lead, and 126,877 pounds of zinc. The Diamond Gold Mining Co. operated during the first 7 months of 1945, shipping zinc-lead ore from the Mountain Top mine and lead and silver ores from the Kirby mine to a smelter. The Root Zinc Lease worked the Root Zinc mine throughout 1945, except for the period July through September; 251 tons of zinc-lead ore containing 1 ounce of gold, 2,388 ounces of silver, 396 pounds of copper, 40,772 pounds of lead, and 179,894 pounds of zinc, were shipped to a smelter. L. F. Jacobson continued to operate at the Sultan mine, milling zinc-lead ore in a 75-ton gravity-concentration plant to produce 293 tons of zinc-lead concentrate containing 2 ounces of gold, 4,888 ounces of silver, 610 pounds of copper, 161,054 pounds of lead, and 87,267 pounds of zinc; in addition, 1,194 tons of zinc ore containing 7 ounces of gold, 10,784 ounces of silver, 2,372 pounds of copper, 221,102 pounds of lead, and 510,300 pounds of zinc were shipped to a smelter. The Coronodo Copper & Zinc Co. worked the Yellow Pine mine during the first 6 months of 1945 and shipped zinc-lead ore to a smelter.

ELKO COUNTY

Contact (*Salmon River*) *district.*—The Marshall Mining Co. shipped to a smelter during 1945, 5,227 tons of gold-silver ore containing 47 ounces of gold, 3,669 ounces of silver, and 252,560 pounds of copper. E. A. Yadon operated the Queen of the Hills mine during 1945 shipping copper ore to a smelter.

Cope (*Mountain City*) *district.*—The Mountain City Copper Co. (the third-largest copper producer in Nevada) operated throughout 1945; most of the ore was treated in the company 400-ton flotation mill, but some high-grade copper ore was shipped for direct smelting.

Delano district.—The Cleveland mine was worked by lessees Harrison, McWhorter, McFarland, and Hullinger throughout 1945 and produced 39 tons of silver ore containing 724 ounces of silver, 408 pounds of copper, and 1,494 pounds of zinc, and 2,146 tons of lead ore containing 20 ounces of gold, 64,727 ounces of silver, 15,757 pounds of copper, and 745,779 pounds of lead.

Dolly Varden district.—The International Smelting & Refining Co. shipped copper ore from the Victoria mine in May and June 1945.

The Anaconda Copper Mining Co. also made a shipment of gold-silver ore from the Victoria mine in 1945.

Loray district.—During the last quarter of 1945 Charles E. Roberts shipped old tailings containing silver and lead to a smelter from the Maybelle mine.

Merrimac district.—A small clean-up of lead concentrates was shipped to a smelter in 1945 from the Rip Van Winkle mine, which suspended operations November 1, 1944.

Spruce Mountain district.—R. J. Birch worked the Monarch mine throughout 1945, shipping lead ore and silver ore to a smelter. The Nevada Lead Zinc Co., operating throughout 1945, shipped zinc-lead ore to a smelter from the Nevada Lead mine. William J. Walker shipped slag from the old Spruce Mountain smelter dump during the last 6 months of 1945.

ESMERALDA COUNTY

Divide district.—The Divide mine, operated by lessees throughout 1945, produced 2,582 ounces of gold and 12,181 ounces of silver from 2,378 tons of gold ore shipped to a smelter.

Silver Peak district.—Fred Vollmar shipped gold ore to a smelter from the Mary mine during 1945.

EUREKA COUNTY

Eureka district.—The Callahan Zinc-Lead Co. worked the Mount Hope mine throughout 1945. The company completed erection of its 200-ton flotation mill and operated it from July 1 to the end of the year, treating all the company ore mined in 1945. Treatment of 19,243 tons of zinc-lead ore produced 95 tons of lead concentrate (containing 7 ounces of gold, 11,504 ounces of silver, 1,093 pounds of copper, 113,240 pounds of lead, and 15,200 pounds of zinc) and 2,346 tons of zinc concentrate (containing 10 ounces of gold, 4,701 ounces of silver, 11,589 pounds of copper, 15,624 pounds of lead, and 2,261,075 pounds of zinc), which were shipped to smelters. The Mountain View Mining Co. operated the Mountain View mine during the first half of 1945 and shipped zinc ore to a smelter.

HUMBOLDT COUNTY

Awakening district.—Austin Bros. Gold Mining Co. treated gold ore from the Jumbo mine by amalgamation during 1945.

Potosi district.—Getchell Mine, Inc., operating for the first 4 months of 1945, treated gold ore from the Getchell mine in a 1,000-ton cyanide plant. In addition, a small tonnage of ore was shipped direct to a smelter. Mining was suspended about May 1, 1945, due to shortage of labor and materials.

LANDER COUNTY

Battle Mountain district.—Lessees operated the Copper Canyon Mining Co. Copper Basin property during 1945; copper ore was shipped to a smelter. The Copper Canyon mine and 350-ton flotation mill of the Copper Canyon Mining Co. were operated under lease until November 30, 1945, by the International Smelting & Refining Co. and then throughout December 1945 by the owners; copper concentrates were shipped to a smelter. O'Leary & Troester worked the Copper Queen mine during the first 4 months of 1945 and shipped copper ore to a smelter. Claude A. Post, lessee, worked the Gold Butte mine and shipped 464 tons of gold-silver ore (containing 40 ounces of gold, 3,410 ounces of silver, 590 pounds of copper, and 27,866 pounds of lead) to a smelter. Symanzik & Wrobel worked the Trinity mine throughout 1945; 176 tons of zinc-lead ore containing 22 ounces of gold, 5,556 ounces of silver, 581 pounds of copper, 32,379 pounds of lead, and 28,952 pounds of zinc were shipped to a concentrator-smelter, and in addition 328 tons of silver ore containing 28 ounces of gold, 4,297 ounces of silver, 521 pounds of copper, and 16,600 pounds of lead were shipped for direct smelting.

Bullion district.—Willow Creek Mines, Inc., worked the Goldacres mine throughout 1945. Ore mined by open-pit method was treated at the company 300-ton cyanide mill.

New Pass district.—Wayne E. Smith worked the Thomas W. mine throughout 1945 and amalgamated 320 tons of ore, which yielded 171 ounces of gold and 24 ounces of silver.

LINCOLN COUNTY

Comet district.—Comet Mines, Inc., worked the Comet mine during the latter months of 1945; 270 tons of zinc-lead ore treated by flotation yielded 15 tons of lead concentrate containing 3 ounces of gold, 815 ounces of silver, 12,089 pounds of lead, and 1,785 pounds of zinc and 67 tons of zinc concentrate containing 2 ounces of gold, 577 ounces of silver, 1,857 pounds of lead, and 70,739 pounds of zinc. In addition, 53 tons of lead ore containing 17 ounces of gold, 584 ounces of silver, 210 pounds of copper and 8,513 pounds of lead were shipped for direct smelting.

Groom district.—The International Mining Corp. worked the Groom mine throughout 1945; 2,194 tons of lead ore containing 5 ounces of gold, 8,304 ounces of silver, 5,893 pounds of copper, and 658,916 pounds of lead were shipped to a smelter. The company 50-ton flotation mill remained idle during 1945.

Jack Rabbit district.—The Bristol Silver Mines Co. worked the Bristol Silver mine throughout 1945; 858 tons of copper ore containing 3 ounces of gold, 7,424 ounces of silver, 54,730 pounds of copper, and 24,670 pounds of lead, and 4,643 tons of zinc ore containing 19 ounces of gold, 41,505 ounces of silver, 167,201 pounds of copper, 364,202 pounds of lead, and 603,259 pounds of zinc were shipped to a smelter.

Pioche district.—The Combined Metals Reduction Co. operated its 500-ton flotation mill at Pioche, Nev., at full capacity, treating both company and custom ore throughout 1945. Company ore for the mill was derived from the Abe Lincoln, Amalgamated Pioche, and Pioche 802 properties (which with the Raymond Ely West mine had been called Pioche Nos. 1 and 2 group). In addition to company-produced ore, the mill treated zinc-lead ore from the Raymond Ely West and Ely Valley mines, and a smaller quantity of zinc-lead ore from the Prince Consolidated Mining Co.'s Prince mine. The Salt Lake-Pioche Mining Co. worked the Apex and Financier mines throughout 1945. Silver ore totaling 562 tons, containing 37 ounces of gold, 12,001 ounces of silver, 178 pounds of copper, and 36,805 pounds of lead, was shipped to a smelter from the Apex mine. The content of 1,323 tons of lead ore shipped from the Financier mine (which was leased to Free Bros.) was 105 ounces of gold, 49,091 ounces of silver, 1,010 pounds of copper, and 375,236 pounds of lead. The Queen Mining Co., operating from June 16 to September 1, shipped 372 tons of gold-silver smelting ore containing 64 ounces of gold, 1,889 ounces of silver, 1,445 pounds of copper, and 15,922 pounds of lead.

LYON COUNTY

Yerington district.—Anton Lilja, lessee, worked the Mason Valley mine all year and shipped 1,941 tons of copper ore, containing 5 ounces of gold, 454 ounces of silver, 170,264 pounds of copper, and 835 pounds of lead, to a smelter. Ed Parr shipped copper ore to a smelter from the Malachite mine during 1945. Eleanor S. Manson operated the Western Nevada mine January through September and shipped 1,373 tons of gold-silver ore containing 8 ounces of gold, 280 ounces of silver, and 69,357 pounds of copper. The Angelus Basin Copper Co. shipped copper ore to a smelter in 1945 from the Northern Lights mine.

MINERAL COUNTY

Columbus (Candelaria) district.—During the last 6 months of 1945, Charles R. Hammock shipped tailings from the Columbus mine containing silver and lead to a smelter.

Santa Fe district.—L. Wilson and J. A. Simpson operated the Mary mine during 1945 and shipped zinc-lead ore to a custom mill.

Silver Star district.—During the first 6 months of 1945, Charles R. Hammock shipped tailings containing silver, copper, and lead from the Copper Blossom mine to a smelter.

NYE COUNTY

Bullfrog district.—The Burm Ball Mining Co. shipped gold-silver ore to a smelter from the Bullfrog mine during 1945.

Manhattan district.—The Manhattan Gold Dredging Co., the only large producer of placer gold in the State in 1945, operated an electric-powered, connected-bucket dredge throughout the year. The dredge was equipped with 108 9½-cubic foot buckets.

Quartz Mountain district.—Louis Warnken, Jr., shipped dump ore containing gold, silver, and lead to a smelter during 1945. Obie Lefavor, lessee, worked the San Rafael mine during 1945 and shipped lead ore to a smelter.

Tonopah district.—Lessees worked the property of the Tonopah Mining Co. of Nevada during 1945 and shipped gold-silver ore containing 486 ounces of gold and 47,274 ounces of silver to a smelter.

Tybo district.—E. S. and V. J. Barndt, lessees, worked the Tybo group of mines the latter half of 1945 and shipped lead ore and old smelter slag containing silver and lead to a smelter.

Union district.—L. D. Foreman & Co., shipped material from the Lodivale and Montezuma old slag dump to a smelter.

PERSHING COUNTY

Aldrich district.—Potter & Rainey operated the Valmy mine from April through November 1945 and shipped lead ore to a smelter.

Antelope (Majuba) district.—The Greenan-Kerr Tin Mine ceased operations in May 1945, and the partnership was dissolved. During the first months of 1945, 2,513 tons of copper ore containing 19 ounces of gold, 3,391 ounces of silver, and 153,364 pounds of copper were shipped to a smelter.

Seven Troughs district.—The Portland mine was operated by several lessees throughout 1945; gold ore produced was treated by amalgamation and concentration.

STOREY COUNTY

Comstock district.—The Dayton Consolidated Mines Co. operated the company custom cyanide mill at Silver City, Lyon County, treating gold ore from the Keystone mine, the Overman mine, and various smaller shippers.

WASHOE COUNTY

Galena district.—The Union Lead Mining & Smelting Co. treated zinc-lead ore from the Union Lode mine by jig concentration and shipped the product to custom concentrators for selective flotation. In addition, a small tonnage of silver ore was shipped to a smelter.

White Horse (Olinghouse) district.—Lessees treated 86 tons of ore by amalgamation at the Texas No. 2 lode mine and recovered 41 ounces of gold and 16 ounces of silver.

WHITE PINE COUNTY

Aurum (Silver Mountain) district.—The Grand Deposit Mining Co. operated the Grand Deposit mine throughout 1945 and shipped 1,002 tons of copper ore containing 11 ounces of gold, 1,033 ounces of silver, and 77,632 pounds of copper and 6,282 tons of zinc ore containing 31 ounces of gold, 7,313 ounces of silver, 91,284 pounds of copper, 112,123 pounds of lead, and 2,228,351 pounds of zinc. A new Diesel compressor and Diesel-electric generating plant were installed at the property in 1945.

Hunter district.—L. D. Foreman & Co. shipped material from the Hunter old-slag dump during 1945.

Osceola district.—The Gilded Age Mining Co. worked the Gilded Age mine the latter half of 1945 and shipped gold ore to a smelter.

Robinson (Ely) district.—The Nevada Mines Division of the Kennecott Copper Corp. worked the Copper Flat pit and Ruth mine throughout 1945 and produced over half of the total ore and over half the total copper for the State. The corporation also advanced to first place in production of gold in Nevada. This company, the largest privately financed industrial organization in Nevada, also operated the McGill flotation concentrator (daily capacity, 20,000 tons) and the McGill copper smelter, both at McGill where the product of its mines and that of the Consolidated Coppermines Corp. were treated. By mutual agreement between Kennecott Copper Corp. and Consolidated Coppermines Corp. the Kennecott Liberty pit was being extended to the west during 1945 to provide for the mining by Kennecott of Coppermines ores in this area. The Consolidated Coppermines Corp., second-largest copper and gold producer in the State in 1945, worked the Emma, Morris, and Richard mines throughout 1945. Production by both companies was slightly under their 1944 output. Sam Robison shipped to a smelter from the Columbia mine 3,401 tons of zinc ore containing 50 ounces of gold, 7,241 ounces of silver, 10,240 pounds of copper, 223,298 pounds of lead, and 976,097 pounds of zinc. L. D. Foreman & Co. shipped material containing silver and lead from the King old-slag dump. The Smith, Siegle, Bibson Co. worked the Veterans mine throughout 1945 and shipped copper ore to a smelter. Ernest R. Wooley shipped lead ore from the Young Treasure mine to a smelter.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN NEW MEXICO

(MINE REPORT)

By G. E. Woodward and S. A. Gustavson

SUMMARY OUTLINE

SUMMARY

Chiefly due to conditions arising from the war, the production of gold, silver, copper, and zinc from New Mexico mines decreased in 1945; the output of lead increased principally because of a change in the grade of ore mined by three of the leading producers in the State. The greatest single factor affecting production was the serious shortage of labor, which was more acute during the first 10 months of 1945 than in any period during the war. In November and December 1945 the labor shortage was relieved somewhat at various operations.

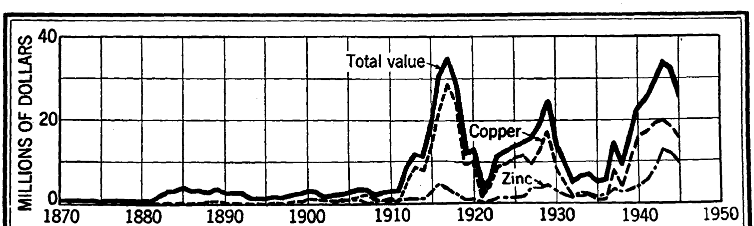

FIGURE 1.—Value of mine production of copper and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico, 1870–1945. The value of gold, silver, and lead produced annually has been relatively small.

In 1945 the production (in terms of recovered metals) of gold was 5,604 fine ounces, silver 465,127 ounces, copper 113,142,000 pounds, lead 15,324,000 pounds, and zinc 80,590,000 pounds valued at $26,386,781, compared with 6,918 ounces of gold, 535,275 ounces of silver, 139,460,000 pounds of copper, 14,530,000 pounds of lead, and 101,454,000 pounds of zinc valued at $32,178,026 in 1944. A comparison of mine production in 1945 with 1944 and former years shows: Gold production decreased 19 percent from 1944 and except for 1943 was the lowest since 1876; silver decreased 13 percent and was the lowest since 1926; copper decreased 19 percent but was greater than during any year prior to 1940; lead increased 5 percent in quantity and 13 percent in value and exceeded any year except those during the period 1927 through 1934, with a peak in 1931 of 22,537,000 pounds; and zinc decreased 21 percent in quantity and 20 percent in value and was the highest of any year prior to 1942—the peak of 119,048,000 pounds was reached in 1943.

Of the 10 counties producing in New Mexico in 1945, Grant County was by far the largest contributor to the metal output, accounting for 94 percent of the State total value, and ranking first in the production of each of the five metals. Socorro County produced these five metals valued at 3 percent of the State total, Hidalgo County 2 percent, and all other counties 1 percent.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1945, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	396	39,623	10,210,000	1,068,000	7,366,000
February	449	39,153	9,634,000	1,272,000	7,742,000
March	569	47,848	10,202,000	1,834,000	8,402,000
April	429	33,200	9,792,000	1,076,000	6,630,000
May	553	36,467	10,096,000	1,148,000	7,434,000
June	434	41,138	9,620,000	1,366,000	6,894,000
July	435	38,043	9,520,000	1,202,000	6,426,000
August	535	44,362	9,170,000	1,308,000	5,844,000
September	515	35,914	7,534,000	1,070,000	5,842,000
October	523	40,912	9,336,000	1,506,000	6,540,000
November	411	34,433	8,686,000	1,272,000	5,822,000
December	355	34,034	9,342,000	1,202,000	5,648,000
	5,604	465,127	113,142,000	15,324,000	80,590,000

The following table shows the number of mines in New Mexico producing gold, silver, copper, lead, and zinc and their annual output of ore and metals from 1941 to 1945, as well as the total production from 1848 to 1945. The report of this series for 1929 (chapter of Mineral Resources of the United States, 1929, pt. 1, pp. 729–759) gives the yearly production of each important metal-producing district in New Mexico from 1904 to 1929, inclusive. Subsequent records year by year may be found in annual issues of Mineral Resources and Minerals Yearbook.

Mine production of gold, silver, copper, lead, and zinc in New Mexico, 1941–45, and total, 1848–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	145	103	7, 530, 226	27, 845	$974, 575	1, 328, 317	$944, 581
1942	78	48	8, 221, 512	11, 961	418, 635	676, 170	480, 832
1943	64	16	8, 329, 043	5, 563	194, 705	463, 583	329, 659
1944	55	3	7, 943, 846	6, 918	242, 130	535, 275	380, 640
1945	46	4	6, 843, 327	5, 604	196, 140	465, 127	330, 757
1848–1945			(1)	2, 178, 826	49, 593, 103	67, 416, 731	52, 672, 094

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	146, 956, 000	$17, 340, 808	9, 336, 000	$532, 152	75, 724, 000	$5, 679, 300	$25, 471, 416
1942	160, 200, 000	19, 384, 200	9, 216, 000	617, 472	92, 922, 000	8, 641, 746	29, 542, 885
1943	152, 326, 000	19, 802, 380	11, 446, 000	858, 450	119, 048, 000	12, 857, 184	34, 042, 378
1944	139, 460, 000	18, 827, 100	14, 530, 000	1, 162, 400	101, 454, 000	11, 565, 756	32, 178, 026
1945	113, 142, 000	15, 274, 170	15, 324, 000	1, 317, 864	80, 590, 000	9, 267, 850	26, 386, 781
1848–1945	(2) 1, 300, 008	382, 166, 833	(2) 269, 942	27, 487, 917	(2) 808, 837	117, 219, 060	629, 139, 007

(1) Figures not available. (2) Short tons.

Gold and silver produced at placer mines in New Mexico, 1941–45, in terms of recovered metals

Year	Gold		Silver		Total value	Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value			Fine ounces	Value	Fine ounces	Value	
1941	2, 488	$87, 080	284	$202	$87, 282	1944	8	$280			$280
1942	1, 247	43, 645	135	96	43, 741	1945	15	525	7	$5	530
1943	92	3, 220	25	18	3, 238						

Gold.—On June 16, 1945, the War Production Board announced that resumption of gold mining would be permitted through revocation of its Limitation Order L–208, effective July 1, 1945. Rescinding of this order did not affect the gold output from New Mexico during the year. Mine production of recovered gold in New Mexico decreased from 6,918 ounces in 1944 to 5,604 ounces in 1945. The principal gold-producing districts in 1945 were: Central, Grant County, which produced 29 percent of the State output of recovered gold; Mogollon, Catron County, 25 percent; Lordsburg, Hidalgo County, 25 percent; and Steeple Rock, Grant County, 17 percent. All others produced about 4 percent. Dry and siliceous ores yielded 53 percent of the State total gold; zinc-lead ore 33 percent; copper ore 10 percent; and lead and zinc ores and placers 4 percent. The principal producers in 1945, in order of output, were as follows: The Silver Creek Mining Co. in Catron County, United States Smelting, Refining & Mining Co. (Bullfrog and other company properties) in Grant County, Atwood mine in Hidalgo County, Elayer & Richmond (Center mine) in Grant County, Banner Mining Co. in Hidalgo County, Exploration Syndicate, Inc. (Carlisle mine) in Grant County, New Mexico Ore Processing Co. (Peerless mine) in Grant County, and American Smelting & Refining Co. (Ground Hog group) in Grant County. These eight properties produced 93 percent of the State total output of gold.

Silver.—Mine production of recovered silver in New Mexico declined from 535,275 fine ounces in 1944 to 465,127 ounces in 1945—a 13-percent decrease. The principal silver-producing districts in 1945 were: Central, Grant County, which produced 44 percent of the State total; Mogollon, Catron County, 20 percent; Lordsburg, Hidalgo County, 19 percent; Magdalena, Socorro County, 8 percent; Steeple Rock, Grant County, 6 percent; and Pinos Altos, Grant County, 2 percent. Production of silver from these six districts amounted to 99 percent of the State total. Of the total silver produced in the State during 1945 zinc-lead ore yielded 51 percent, dry and siliceous ores 34 percent, copper ore 5 percent, and lead and zinc ores and placers 10 percent. The following 12 producers, in order of output, contributed 92 percent of the State total: The United States Smelting, Refining & Mining Co. (Bullfrog mine and other company properties) in Grant County, Silver Creek Mining Co. (Bearup group) in Catron County, Atwood mine in Hidalgo County, American Smelting & Refining Co. (Ground Hog Unit) in Grant County, American Smelting & Refining Co. (Magdalena Unit) in Socorro County, Banner Mining Co. (Bonney mine group) in Hidalgo County, Exploration Syndicate, Inc. (Carlisle mine), in Grant County, Empire Zinc Co. (Hanover mine group) in Grant County, Black Hawk Consolidated Mines Co. (Hobo and Hobo No. 2 mines) in Grant County, New Mexico Ore Processing Co. (Peerless mine) in Grant County, and McDonald & Dobson (Nitt properties) in Socorro County.

Copper.—Mine production of recovered copper in New Mexico in 1945 was 113,142,000 pounds, a 19-percent decrease from 1944. The Chino open-pit mine of the Kennecott Copper Corp. at Santa Rita, Grant County, was by far the largest copper producer in the State; the second-largest was the leaching operation at the Burro Mountain properties of the Phelps Dodge Corp. at Tyrone, Grant County. Other substantial producers (in order of output) were the Bonney mine south of Lordsburg, Hidalgo County, operated by the Banner Mining Co.; the Bullfrog and other company properties operated by the United States Smelting, Refining & Mining Co., Grant County; the Atwood group of mines operated by C. H. & S. A. McIntosh; and the Ground Hog Unit operated by the American Smelting & Refining Co., Grant County. The above six mines produced 99 percent of the total State production of copper in 1945; of the total copper produced copper ore, mine-water precipitates, and precipitates from leaching dump material accounted for 98 percent and lead, zinc, and zinc-lead ores virtually all of the remainder.

Lead.—Lead production in New Mexico in 1945 increased 5 percent in quantity and 13 percent in value over 1944 although the total tonnage of lead, zinc-lead, and zinc ores decreased. This increase in production of lead can be accounted for largely by an increase in the lead content of the ore mined at several of the more important lead-producing properties in the State. Zinc-lead ore yielded 85 percent of the total lead, lead ore 10 percent, zinc ore 4 percent, and all others 1 percent. The principal lead-producing districts in 1945 were the Central, Grant County (70 percent); Magdalena, Socorro County (16 percent); Steeple Rock, Grant County (7 percent); Lordsburg, Hidalgo County (2 percent); and San Simon, Hidalgo County (2 percent). The 10 largest producers of lead in New Mexico accounted for 94 percent of the State total; in order of output they were: The United States Smelting, Refining & Mining Co. (Bullfrog and other company properties), Grant County; American Smelting & Refining Co. (Hanover Unit), Grant County; American Smelting & Refining Co. (Magdalena Unit), Socorro County; Black Hawk Consolidated Mines Co. (Hobo and Hobo No. 2), Grant County; Exploration Syndicate, Inc. (Carlisle mine), Grant County; New Mexico Ore Processing Co. (Peerless mine), Grant County; Empire Zinc Co. (Kelly mine group), Socorro County; Byrd Mining Co. (Crosby mine), Hidalgo County; Peru Mining Co. (chiefly the Kearny mine), Grant County; and Empire Zinc Co. (Hanover mine group), Grant County.

Zinc.—Production of recovered zinc in New Mexico in 1945 decreased 21 percent in quantity and 20 percent in value from 1944. Virtually all the major zinc producers in the State, with the exception of the United States Smelting, Refining & Mining Co.—the State's largest producer of zinc (operating the Bullfrog and other company properties in Grant County)—mined less ore in 1945 than in 1944. Although the production of ore from the properties of the United States Smelting, Refining & Mining Co. was greater, its output of zinc in 1945 remained very nearly the same as in 1944.

The 11 leading producers of zinc in New Mexico in 1945 accounted for 99 percent of that metal and in order of output were: The United States Smelting, Refining & Mining Co. operating the Bullfrog mine and other company properties, Empire Zinc Co. operating the Hanover mine unit, Peru Mining Co. and subsidiary operating the Pewabic, Copper Flat, and Kearny mines, American Smelting & Refining Co. operating the Ground Hog group, and the Black Hawk Consolidated Mines Co. operating the Hobo and Hobo No. 2 mines, all in Grant County; American Smelting & Refining Co. operating the Graphic and Waldo mines and Empire Zinc Co. operating the Kelly group, in Socorro County; Kennecott Copper Corp. operating the Oswaldo mine and Exploration Syndicate, Inc., operating the leased Carlisle group, in Grant County; McDonald & Dobson operating the Nitt properties, in Socorro County; and New Mexico Ore Processing Co. operating the Peerless mine, in Grant County.

Zinc-lead ore yielded 62 percent of the total zinc and zinc ore 38 percent. Six mining districts produced all the recovered zinc in the State; they were the Central, Grant County (90 percent); Magdalena, Socorro County (8 percent); and Steeple Rock, Pinos Altos, and Swartz, Grant County, together with Cerrillos, Santa Fe County (2 percent).

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1945, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Catron	2		1,415	$49,525	91,786	$65,270
Coffax		2	5	175	4	3
Grant	22	1	2,665	93,275	241,079	171,434
Guadalupe	1					
Hidalgo	8		1,411	49,385	92,347	65,669
Otero	1				10	7
Sandoval	1				28	20
Santa Fe	3	1	14	490	1,789	1,272
Sierra	4		1	35	1,246	886
Socorro	4		93	3,255	36,838	26,196
	46	4	5,604	196,140	465,127	330,757
Total, 1944	55	3	6,918	242,130	535,275	380,640

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Catron							$114,795
Colfax							178
Grant	110,644,000	$14,936,940	12,030,000	$1,034,580	74,382,000	$8,553,930	24,790,159
Guadalupe	93,000	12,555					12,555
Hidalgo	2,294,000	309,690	690,000	59,340			484,084
Otero	2,000	270					277
Sandoval	2,000	270					290
Santa Fe	2,000	270	102,000	8,772	120,000	13,800	24,604
Sierra	1,000	135	16,000	1,376			2,432
Socorro	104,000	14,040	2,486,000	213,796	6,088,000	700,120	957,407
	113,142,000	15,274,170	15,324,000	1,317,864	80,590,000	9,267,850	26,386,781
Total, 1944	139,460,000	18,827,100	14,530,000	1,162,400	101,454,000	11,565,756	32,178,026

MINING INDUSTRY

During most of 1945 skilled labor virtually was unobtainable and common labor very short in the metal-mining industry of New Mexico; however, near the end of the year this situation was alleviated. Absenteeism continued to be high, especially on the second and third shifts. Materials and supplies were more difficult to obtain. In June Congress passed legislation to permit continuation of the premium-price plan for copper, lead, and zinc until June 30, 1946. The plan was extended on about the same basis as heretofore and included the noncancellation requirement—meaning that all classes of premiums shall be noncancellable unless necessary in order to make individual adjustments of income to specific mines. Properties continued to be subject to quota revisions, which often had a disturbing effect on the trend of metal production. On June 16, 1945, the War Production Board announced that resumption of gold mining would be permitted through the revocation of WPB Limitation Order L-208, effective July 1, 1945. The removal of this restriction had virtually no effect on mine production in New Mexico during the remainder of the year. Production of ore from metal mines in New Mexico decreased 14 percent in 1945 from 1944.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in New Mexico in 1945, with content in terms of recovered metals

Source	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	1,412	784	2,831	10,809	24,972	
Dry and siliceous gold-silver ore	13,068	2,197	155,694	488,597	188,220	
Dry and siliceous silver ore	3		22			
	14,483	2,981	158,547	499,406	213,192	
Copper ore	6,228,727	557	[1] 23,460	[2] 111,065,644	1,873	
Lead ore	4,627	171	17,855	34,643	1,459,214	
Zinc ore	265,931	55	29,687	160,245	581,677	30,384,285
Zinc-lead ore	329,559	1,825	235,571	1,382,062	13,068,044	50,205,715
	6,828,844	2,608	[1] 306,573	[2] 112,642,594	15,110,808	80,590,000
Total, lode mines	6,843,327	5,589	[1] 465,120	[2] 113,142,000	15,324,000	80,590,000
Total, placers		15	7			
	6,843,327	5,604	[1] 465,127	[2] 113,142,000	15,324,000	80,590,000
Total, 1944	7,943,846	6,918	535,275	[3] 139,460,000	14,530,000	101,454,000

[1] Includes 381 ounces of silver recovered from precipitates from mine water and leached dumps.
[2] Includes 23,855,551 pounds of copper recovered from precipitates from mine water and leached dumps.
[3] Includes 23,936,645 pounds of copper recovered from precipitates from mine water and leached dumps.

METALLURGIC INDUSTRY

Of the 6,843,327 tons of ore from New Mexico mines in 1945, 99 percent (6,764,415 tons) was treated at 10 concentrating plants and 1 percent (78,912 tons) was shipped crude to smelters. Of the 6,764,415 tons of ore sent to concentrating plants, 6,168,925 tons were copper ore, 329,559 tons zinc-lead ore, and 265,931 tons zinc ore. Of the 78,912 tons of ore sent crude to smelters, 59,802 tons were copper ore, 13,068 tons gold-silver ore, 4,627 tons lead ore, 1,412 tons gold ore, and 3 tons silver ore. Most of the copper ore shipped crude to smelters was highly siliceous and was used as flux at the El Paso, Tex., and Hurley copper smelters.

The 10 concentrating plants operating in New Mexico in 1945 were: The Hanover unit of the American Smelting & Refining Co. (company and custom zinc and zinc-lead ores); Magdalena unit of the American Smelting & Refining Co. (company zinc-lead ore); Banner mill of the Banner Mining Co. (company copper ore); East Camp mill of the Exploration Syndicate Inc. (company zinc-lead ore); Hanover Milling Unit of the Empire Zinc Co. (company and custom zinc and zinc-lead ores); Hurley concentrating unit of the Kennecott Copper Corp. (company copper ore); Moline mill of the Moline Mining & Milling Co. (company zinc-lead ore); Continental mill of the New Mexico Ore Processing Co., which was shut down in February 1945 (company zinc-lead ore); Peru mill of the Peru Mining Co. (company zinc and custom zinc-lead ores); Bullfrog mill of the United States Smelting, Refining & Mining Co. (company zinc-lead ore).

The Chino reverberatory copper smelter of the Kennecott Copper Corp. was operated throughout 1945 and treated company copper concentrates, siliceous copper ore, and copper precipitates; the precipitates were derived from the company operation at Chino and company operation at Ray, Ariz. All of the copper produced during the year was marketed as fire-refined copper bars. Other smelters receiving ore and concentrates from New Mexico mines in 1945 were: The American Smelting & Refining Co. copper smelter and lead smelter at El Paso, Tex., zinc smelter at Amarillo, Tex., and electrolytic zinc plant at Corpus Christi, Tex.; American Zinc Co. of Illinois zinc smelter at East St. Louis; American Zinc Co. of Illinois zinc smelter at Dumas, Tex.; Anaconda Copper Mining Co. electrolytic zinc plant at Anaconda, Mont.; International Smelting & Refining Co. copper smelter at Miami, Ariz.; New Jersey Zinc Co. of Pennsylvania zinc plant at Palmerton Pa.; and New Jersey Zinc Co. Mineral Point Division zinc plant at Depue, Ill.

Mine production of metals in New Mexico in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Concentrates smelted	266, 259	2, 407	[1] 287, 960	[2] 110, 782, 151	13, 651, 594	80, 590, 000
Ore smelted	78, 912	3, 182	177, 160	2, 359, 849	1, 672, 406	
Placer		15	7			
Total		5, 604	465, 127	113, 142, 000	15, 324, 000	80, 590, 000
1944		6, 918	535, 275	139, 460, 000	14, 530, 000	101, 454, 000

[1] Includes 381 ounces of silver recovered from precipitates from mine water and leached dumps.
[2] Includes 23,855,551 pounds of copper recovered from precipitates from mine water and leached dumps.

Gross metal content of concentrates (all produced at concentrating mills) from ores mined in New Mexico in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (wet assay) (pounds)	Lead (wet assay) (pounds)	Zinc (pounds)
Copper	173, 301	5, 076	[1] 96, 583	[2] 111, 492, 912	3, 121	
Lead	10, 320	1, 188	146, 893	700, 707	11, 855, 295	1, 781, 863
Lead-copper	516	35	15, 601	66, 270	454, 142	
Zinc	82, 122	679	113, 476	1, 068, 849	2, 163, 240	88, 687, 952
Total	266, 259	6, 978	[1] 372, 553	[2] 113, 328, 738	14, 475, 798	90, 469, 815
1944	346, 165	10, 906	510, 421	[3] 140, 554, 340	15, 152, 388	118, 963, 894

[1] Includes 405 ounces of silver contained in precipitates from mine water and leached dumps.
[2] Includes 24,348,144 pounds of copper contained in precipitates from mine water and leached dumps.
[3] Includes 24,449,757 pounds of copper contained in precipitates from mine water and leached dumps.

Mine production of metals from concentrating mills in New Mexico in 1945, in terms of recovered metals

BY COUNTIES

	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Grant	6,647,221	253,964	1,818	[1] 227,895	[2] 108,903,638	11,140,408	74,382,000
Hidalgo	72,311	3,553	527	22,321	1,775,255	1,873	----------
Santa Fe	1,844	208	6	1,786	2,000	102,000	120,000
Socorro	43,039	8,534	56	35,958	101,258	2,407,313	6,088,000
	6,764,415	266,259	2,407	[1] 287,960	[2] 110,782,151	13,651,594	80,590,000
Total, 1944	7,850,208	346,165	4,031	389,059	[3] 137,170,486	13,003,780	101,392,994

BY CLASSES OF ORE CONCENTRATED

	Ore treated (short tons)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	6,168,925	173,301	527	[1] 22,702	[2] 109,239,844	1,873	----------
Zinc	265,931	33,195	55	29,687	160,245	581,677	30,384,285
Zinc-lead	329,559	59,763	1,825	235,571	1,382,062	13,068,044	50,205,715
	6,764,415	266,259	2,407	[1] 287,960	[2] 110,782,151	13,651,594	80,590,000

[1] Includes 381 ounces of silver recovered from precipitates from mine water and leached dumps.
[2] Includes 23,855,551 pounds of copper recovered from precipitates from mine water and leached dumps.
[3] Includes 23,936,645 pounds of copper recovered from precipitates from mine water and leached dumps.

Gross metal content of New Mexico crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	1,412	784	2,831	11,228	41,620	----------
Dry and siliceous gold-silver	13,068	2,197	155,694	508,495	304,710	588
Dry and siliceous silver	3	----------	22	----------	----------	----------
Copper	59,802	30	758	1,865,790	----------	----------
Lead	4,627	171	17,855	40,945	1,521,718	36,545
	78,912	3,182	177,160	2,426,458	1,868,048	37,133
Total, 1944	93,638	2,880	146,303	2,369,094	1,810,987	77,111

Mine production of metals from New Mexico crude ore shipped to smelters in 1945, by counties, in terms of recovered metals

County	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Catron	2,017	1,415	91,786	----------	----------	----------
Grant	61,001	845	13,184	1,740,362	889,592	----------
Guadalupe	1,850	----------	----------	93,000	----------	----------
Hidalgo	13,576	884	70,026	518,745	688,127	----------
Otero	59	----------	10	2,000	----------	----------
Sandoval	19	----------	28	2,000	----------	----------
Sierra	58	1	1,246	1,000	16,000	----------
Socorro	332	37	880	2,742	78,687	----------
	78,912	3,182	177,160	2,359,849	1,672,406	----------
Total, 1944	93,638	2,879	146,216	2,289,514	1,526,220	61,006

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in New Mexico in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (fine ounces)			Silver (fine ounces)			Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer		Lode	Placer	Total	Lode	Placer	Total				
Catron County: Mogollon	2		2,017	1,415		1,415	91,786		91,786				$114,795
Colfax County: Mount Baldy		2			5	5		4	4				178
Grant County:													
Central	[1] 14		[1] 6,682,463	1,609		1,609	[1] 204,127		[1] 204,127	[1] [2] 110,394,200	10,757,300	72,489,600	24,366,121
Gila River	1		3	1		1	21		21				50
Pinos Altos	2	1	4,815	90	2	92	10,426		10,426	14,400	116,000	595,200	91,002
Steeple Rock	3		19,366	963		963	25,494		25,494	232,200	1,079,500	1,156,400	309,004
Swartz	2		1,575				1,011		1,011	3,200	77,200	140,800	23,982
Guadalupe County	1		1,850							93,000			12,555
Hidalgo County:													
Gillespie (Red Hill)	1		238				637		637		33,600		3,343
Lordsburg	6		84,773	1,411		1,411	90,336		90,336	2,292,800	337,200		452,151
San Simon	1		876				1,374		1,374	1,200	319,200		28,590
Otero County: Sacramento	1		59				10		10	2,000			277
Sandoval County: Cochiti	1		19				28		28	2,000			290
Santa Fe County:													
Cerrillos	3		1,844	6		6	1,786		1,786	2,000	102,000	120,000	24,322
San Pedro (New Placers)		1			8	8		3	3				282
Sierra County:													
Hermosa	3		9	1		1	993		993		4,500		1,128
Kingston	1		49				253		253	1,000	11,500		1,304
Socorro County: Magdalena	4		43,371	93		93	36,838		36,838	104,000	2,486,000	6,088,000	957,407
Total New Mexico	46	4	6,843,327	5,589	15	5,604	465,120	7	465,127	[2] 113,142,000	15,324,000	80,590,000	26,386,781

[1] Includes Burro Mountain district, figures for which Bureau of Mines is not at liberty to publish separately.
[2] Includes copper recovered from precipitates.

CATRON COUNTY

Mogollon district.—The Silver Creek Mining Co. operated the Eureka mine (part of the Bearup group) throughout 1945 and shipped 1,996 tons of dry gold-silver ore containing 1,403 ounces of gold, 90,902 ounces of silver, and 1,262 pounds of copper to the El Paso smelter. The Lehigh Metals Co. shipped one lot of ore, the result of a mill clean-up, to the El Paso, Tex., smelter.

COLFAX COUNTY

Mount Baldy district.—Placer operators sold 5 ounces of gold and 4 ounces of silver to bullion buyers during 1945.

GRANT COUNTY

Burro Mountain (Tyrone) district.—Leaching operations at the Burro Mountain mine of the Phelps Dodge Corp. were continued throughout 1945. Water is percolated through subsided areas of the former mine workings and copper is precipitated from the return solutions. The copper content of the leach water and production of precipitates were slightly less than in 1944, a result of partial channelizing of the water and the lowering of the mineral content of the ore body.

Central district (Bayard, Fierro, Georgetown, Hanover, Santa Rita).—The Chino Mines Division of the Kennecott Copper Corp., the largest copper producer in New Mexico, operated its open-pit mine at Santa Rita and its flotation mill and reverberatory copper smelter at Hurley at near capacity. The mill was operated on a 6-day week. The critical labor shortage at the beginning of the year was eased near the end of the year. Copper produced in 1945 was marketed in the form of fire-refined copper bars; as a result, molybdenite was the only byproduct made from the ore containing gold, silver, copper, and molybdenum. Copper was recovered also by leaching accumulated dump material from the pit and from siliceous copper ore used in the converter as flux. The company continued development of its Oswaldo zinc property and shipped zinc-lead ore to the Empire Zinc Co. mill at Hanover. Development in the Oswaldo mine in 1945 included 4,885 feet of drifts, 79 feet of raises, and 13,987 feet of diamond drilling.

The largest production of zinc and lead in New Mexico in 1945 came from the Bullfrog mine and other company properties operated by the United States Smelting, Refining & Mining Co. The ore was treated in the company 450-ton selective-flotation mill. The lead concentrates made were shipped to the El Paso, Tex., smelter; zinc concentrates were shipped to the Anaconda, Mont., electrolytic plant.

The Empire Zinc Co. operated its Hanover mine group and selective flotation mill throughout 1945 and was the second-largest producer of zinc in the State. In addition to ore from the company properties in the Central district, the mill treated ore from the company Kelly mine group at Kelly, Socorro County, and the Oswaldo mine of the Kennecott Copper Corp. in the Central district. Zinc concentrates were shipped to Palmerton, Pa., and Depue, Ill., smelters.

The Peru Mining Co. and its subsidiary operated the Pewabic, Copper Flat, and Kearny mines throughout 1945. The Copper Flat and Kearny mines were operated by the New Mexico Consolidated Mining Co., a wholly owned subsidiary of the Peru Mining Co. Ore from the mines was treated at the company 1,000-ton selective-flotation mill at Wemple, 5 miles north of Deming, Luna County. Part of the product (chiefly zinc concentrates) was shipped to the Dumas, Tex., smelter and the remainder to the Metals Reserve Company stock pile at Dumas, Tex.; the lead concentrates produced were shipped to the El Paso, Tex., smelter. Custom ore also was treated from the Campbell Junction mine of the Phelps Dodge Corp., Bisbee, Ariz.

The American Smelting & Refining Co. operated throughout 1945 the leased 400-ton Hanover milling unit (formerly Combination-Black Hawk mill) and treated zinc and zinc-lead ores from its Ground Hog group (Ground Hog, Lucky Bill, San Jose, and Denver claims), custom ores, and ores purchased from the Metals Reserve Company (originally from the Hobo mine, Central district). Zinc concentrates were shipped to the electrolytic zinc plant at Corpus Christi, Tex., and lead concentrates to El Paso, Tex., smelters. Crude lead ore from the Denver and San Jose claims was shipped to the El Paso smelter. Development at the Ground Hog group included 10,255 feet of crosscuts and raises and 40,635 feet of diamond drilling; some improvements also were made in mine ventilation. Custom ore treated at the mill (comprising about 50 percent of the total mill feed) was from the Hobo, Hobo No. 2, Peerless, and Little Shingle mines in the Central district, Grant County; Columbia-Grandview and Royal John mines in the Swartz (Carpenter) district, Grant County; Cleveland and Houston-Thomas properties in the Pinos Altos district, Grant County; Tom Payne and Pennsylvania mines in the Cerrillos district, Santa Fe County; and the Nitt properties, Magdalena district, Socorro County.

The Black Hawk Consolidated Mines Co. operated throughout 1945 its Hobo and Hobo No. 2 mines and produced 33,551 tons of zinc-lead ore, which were shipped to the Hanover milling unit of the American Smelting & Refining Co. Development completed at the Hobo No. 2 included 781 feet of drifts and raises and 839 feet of diamond drilling and at the Hobo 2,330 feet of drifts and raises and 2,941 feet of diamond drilling.

The New Mexico Ore Processing Co. operated its Peerless mine until the middle of September, when all operations were suspended. The company 100-ton selective-flotation mill was closed on February 10, 1945, and the zinc-lead ore mined after that date was shipped to the American Smelting & Refining Co. Hanover milling unit. The Shingle Canyon Mining Corp. operated its Little Shingle mine and shipped zinc-lead ore to the Hanover milling unit. Cesario Holguin made a small shipment of gold ore to the El Paso smelter.

Gila River district.—Gallagher & Hightower made a shipment of 3 tons of gold-silver ore to the El Paso, Tex., smelter.

Pinos Altos district.—D. B. White, lessee, operated the Empire Zinc Co. Cleveland mine and shipped zinc ore to the Hanover milling unit. A small shipment of mill tailings was made to the Dumas, Tex., smelter. B. O. Shepherd operated his Houston-Thomas mine and shipped lead ore to the El Paso, Tex., smelter and zinc-lead ore to the Hanover milling unit.

Steeple Rock district.—The Exploration Syndicate, Inc., operated during 1945 its 125-ton selective-flotation mill and leased the Carlisle group of mines. The lead concentrates and zinc concentrates made were shipped to the El Paso, Tex., and Amarillo, Tex., smelters. Mine development consisted of 350 feet of drifts and 420 feet of diamond drilling. Elayer & Richmond operated the Center mine under lease and produced 1,370 tons of dry gold ore containing 744 ounces of gold, 2,807 ounces of silver, 11,104 pounds of copper, and 41,620 pounds of lead. Billingsley Bros. made a small shipment of dry gold-silver ore from the Ontario mine to the El Paso smelter.

Swartz (Carpenter, Camp Monarch) district.—The Black Range Development Co. operated its Grandview and Columbia mines throughout the year and shipped 1,510 tons of zinc-lead ore containing 982 ounces of silver, 4,407 pounds of copper, 88,990 pounds of lead, and 163,581 pounds of zinc to the Hanover milling unit. A. L. Owen shipped 65 tons of zinc-lead ore from the Royal John mine to the Hanover milling unit.

GUADALUPE COUNTY

The Guadalupe Mining Co. operated its Stauber mine from January 1 to March 4, 1945, when all operations were suspended and the mine shut down. The mine produced siliceous copper ore which was shipped to the El Paso, Tex., smelter.

HIDALGO COUNTY

Gillespie (Red Hill) district.—McDonald & Walker operated the Red Hill group of mines and produced 238 tons of lead ore containing 637 ounces of silver, 174 pounds of copper, and 35,077 pounds of lead; the ore was shipped to the El Paso smelter.

Lordsburg district.—The Banner Mining Co., the largest producer in Hidalgo County in 1945, operated its Bonney mine and 500-ton flotation mill throughout 1945; the property is 6 miles south of Lordsburg. The mill was operated three shifts, 6½ days a week, at the beginning of the year and later the operation was reduced to one shift a day; the mill handled an average of 198 tons of ore a day and made copper concentrates which were sent to the El Paso smelter. Development completed included 1,708 feet of drifts and 3,594 feet of diamond drilling. About June 1 the company took over operation of its newly acquired Misers Chest group of mines. These properties, which adjoin the Bonney group, are to be worked through that group. Some siliceous copper ore from the Misers Chest mine was shipped to the Miami, Ariz., smelter by Charles J. Hutchinson, former owner of the Misers Chest.

The Atwood group of claims on Atwood Hill near Valedon 4 miles south of Lordsburg was operated throughout the year by C. H. & S. A. McIntosh. The mine was worked through a three-compartment vertical shaft 800 feet deep with crosscuts to the vein at three levels—the 210-foot, 350-foot, and 500-foot. Prior to 1945 the main operation was confined to the 350-foot level, but during the year the shaft was unwatered to the 500-foot level, where a 200-foot crosscut was driven to the vein. The ore mined was shipped to the El Paso smelter.

The El Paso smelter received lead ore from the Tom group of mines, silver ore from the Silver Peak mine, and gold ore from the property of the Walrich Mining Co.

San Simon (Steins) district.—J. H. Byrd operated the Crosby mine and shipped 876 tons of lead ore containing 1,374 ounces of silver, 1,319 pounds of copper, and 333,014 pounds of lead to the El Paso smelter.

LUNA COUNTY

Deming district.—The Peru Mining Co. 1,000-ton selective-flotation mill at Wemple, 5 miles north of Deming, operated throughout 1945 on ore from the company Pewabic, Copper Flat, and Kearny mines near Hanover, Grant County, and on custom ore from the Phelps Dodge Corp. Campbell Junction mine at Bisbee, Ariz.

OTERO COUNTY

Sacramento district.—The open-cut Courtney mine about 4 miles south of High Rolls was operated from April through the end of the year by its owner, B. D. Lampros. A total of 59 tons of copper ore containing 10 ounces of silver and 2,670 pounds of copper was shipped to the El Paso, Tex., smelter.

SANDOVAL COUNTY

Cochiti district.—J. G. Cleary made a small shipment of copper ore to the El Paso smelter from the San Miguel mine.

SANTA FE COUNTY

Cerrillos district.—The Moline Mining & Milling Co. operated its 35-ton selective-flotation mill (2½ miles north of Los Cerrillos) during the last 3 months of 1945. The mill treated 1,500 tons of zinc-lead ore mined before 1945 from the Franklin group (Cash Entry, Franklin claims, Chicago group, and others). Concentrates made were shipped to the El Paso and Amarillo, Tex., smelters. The Cerrillos Lead & Zinc Co. operated its Pennsylvania group of mines from April 15 to December 31; 291 tons of zinc-lead ore containing 4 ounces of gold, 1,519 ounces of silver, 1,486 pounds of copper, 76,155 pounds of lead, and 102,345 pounds of zinc were produced and shipped to the American Smelting & Refining Co. Hanover milling unit in Grant County. Development completed during the year amounted to 125 feet of shaft and 50 feet of drifts. Mine production was chiefly from the 200-foot level. Andrew B. Stewart shipped 53 tons of lead-zinc ore from the Tom Payne mine to the American Smelting & Refining Co. Hanover milling unit. The ore contained 1 ounce of gold, 124 ounces of silver, 286 pounds of copper, 6,982 pounds of lead, and 13,382 pounds of zinc.

San Pedro (New Placers) district.—J. Quintana sold a few ounces of gold from sluicing on the Golden Placer.

SIERRA COUNTY

Hermosa district.—A. W. Emerick shipped 5 tons of lead ore to the El Paso smelter from his Palomas Chief claim, and A. W. Emerick and E. R. Armour shipped 3 tons of lead ore from their Welford No. 1 claim to the El Paso smelter.

Kingston district.—Everheart & Miller, lessees of the Empire Zinc Co. Kingston group of mines, shipped a small lot of lead ore from the Iron King claim to the El Paso smelter.

SOCORRO COUNTY

Magdalena district.—The American Smelting & Refining Co. operated its Magdalena unit (Waldo mine) and 200-ton selective-flotation mill throughout 1945. The mill was operated three shifts, 4 days a week; lead concentrates and zinc concentrates were sent to the El Paso and Dumas, Tex., smelters. Development completed in the mine included 1,961 feet of drifts and 15,166 feet of diamond drilling, the major portion of which was done on the 15th and 16th levels from a winze sunk in 1944. The Empire Zinc Co. Kelly mine group (Lynchburg, Kelly, Imperial, Young America, and others) was operated during 1945 by lessees (Kenneth Hughes, J. E. Torres, and C. S. Elayer). The zinc-lead ore produced was shipped to the Empire Zinc Co. Hanover milling unit, Grant County, for concentration. McDonald & Dobson operated their Nitt properties throughout the year producing zinc-lead ore which was shipped to the American Smelting & Refining Co. Hanover milling unit for concentration. Several shipments of lead ore were made to the El Paso smelter from the West Star mine by lessees L. Yacoma and M. Fuller and also by the owners, Sadie and Pio Papa.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN OREGON

(MINE REPORT)

By Alfred L. Ransome

SUMMARY OUTLINE

SUMMARY

Production of gold in Oregon in 1945 advanced 226 percent above the 1944 output entirely because dredging operations were resumed, but the total recovered was only 4 percent of the all-time record set in 1940. Silver production was down to half the 1944 output and was the lowest since 1932. The recovery of copper, lead, and zinc was extremely low, but the output of zinc, even though small, was the first since 1937.

The total value of the gold, silver, copper, lead, and zinc (in terms of recovered metals) produced in Oregon was $164,456 in 1945, compared with $63,760 in 1944 and $4,148,271 in the peak year 1940. It was divided among the metals as follows: Gold, 95 percent; silver, 4.5 percent; copper, lead, and zinc each less than 0.2 percent. Baker County was first in total value of metal output in 1945, Grant County being second. Jefferson County dropped to third place from the leading position held in 1944.

The revocation of the War Production Board Limitation Order L-208, effective July 1, 1945, with the end of hostilities soon afterward on August 14, released gold mining from some of its impediments, and a number of properties that had been idle since 1942 resumed production. However, rising wages, the difficulty of obtaining labor, the high cost of supplies and equipment, and the continuing difficulties of obtaining them, high taxes, and a fixed price for gold and silver (principal metals produced in the State) were factors that continued to hold the mining industry down to a rate of production that otherwise might well have been considerably higher. As these factors, at least in part, had less effect upon placer operations, this class of mining promptly forged ahead, but of all the larger gold, silver, copper, lead, and zinc lode mines that had suspended operations before December 31, 1942, only a few had begun to produce by the end of 1945. As some other properties did not operate in 1945, the net result was fewer producing lode mines in 1945 than in 1944.

Placer mines contributed 89 percent and lode mines 11 percent of the gold produced in Oregon in 1945. In 1944, the ratio was placer mines 21 percent and lode mines 79 percent. Thus, the predominance of placer production prevailing for many years prior to 1943 was reestablished.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

Yardage figures used in measuring material treated in placer operations are bank measure; that is, the material is measured in the ground before treatment.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67 + ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Oregon, 1941–45, and total, 1852–1945, in terms of recovered metals

Year	Mines producing [1]		Ore, old tailings, etc. (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	91	153	98,160	96,565	$3,379,775	276,158	$196,379
1942	48	83	31,728	46,233	1,618,155	87,376	62,134
1943	16	16	2,680	1,097	38,395	10,523	7,483
1944	13	10	4,217	1,369	47,915	20,243	14,395
1945	9	10	1,378	4,467	156,345	10,461	7,439
1852–1945	-----------	-----------	(2)	5,673,954	126,551,433	5,218,385	4,788,838

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	166,000	$19,588	118,000	$6,726	-----------	-----------	$3,602,468
1942	296,000	24,926	46,000	3,082	-----------	-----------	1,708,297
1943	12,000	1,560	8,000	600	-----------	-----------	48,038
1944	6,000	810	8,000	640	-----------	-----------	63,760
1945	2,000	270	2,000	172	2,000	$230	164,456
1852–1945	[3] 12,336	4,638,295	[3] 746	76,345	[3] 141	14,076	136,068,987

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Figures not avilable.
[3] Short tons.

Gold produced at placer mines in Oregon, 1941–45, by classes of mines and by methods of recovery

Class and method	Mines producing [1]	Material treated (cubic yards)	Gold recovered		
			Fine ounces	Value	Average per cubic yard
Surface placers:					
Gravel mechanically handled:					
Connected-bucket dredges:					
1941	7	6,670,000	24,131	$844,585	$0.127
1942	6	4,725,000	21,641	757,435	.160
1943–44					
1945	3	1,895,000	3,763	131,705	.070
Dragline: [2]					
1941	25	6,256,000	28,395	993,825	.159
1942	14	2,852,000	13,383	468,405	.164
1943	(3)		5	175	
1944–45					
Suction dredges: [4]					
1941	1	27,000	191	6,685	.248
1942–45					
Nonfloating washing plants: [5]					
1941	17	567,000	2,757	96,495	.170
1942	6	45,000	380	13,300	.296
1943	(3)		17	595	
1944	(3)		71	2,485	
1945					
Gravel hydraulically handled:					
Hydraulic:					
1941	63	683,000	2,306	80,710	.118
1942	41	306,000	1,420	49,700	.162
1943	10	38,000	124	4,340	.114
1944	4	22,700	99	3,465	.153
1945	5	43,000	170	5,950	.138
Small-scale hand methods: [6]					
Wet:					
1941	33	438,300	2,553	89,355	.204
1942	12	220,500	1,462	51,170	.232
1943	4	2,750	52	1,820	.662
1944	6	7,500	123	4,305	.574
1945	2	(7)	53	1,855	
Dry:					
1941	1	100	3	105	1.050
1942–45					
Underground placers:					
Drift:					
1941	6	4,600	94	3,290	.715
1942	4	1,500	50	1,750	1.167
1943	2	250	10	350	1.400
1944–45					
Grand total placer:					
1941	153	14,646,000	60,430	2,115,050	.144
1942	83	8,150,000	38,336	1,341,760	.165
1943	16	41,000	208	7,280	.178
1944	10	30,200	293	10,255	.340
1945	10	1,938,000	3,986	139,510	[8].071

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Includes all placer operations using dragline excavator for delivering gravel to floating washing plant.
[3] Gold from terminal clean-up; property and equipment not counted as producing.
[4] Includes all placer operations using suction pump for delivering gravel to floating washing plant, except those producing less than 100 ounces of gold, which are included under "small-scale hand methods;" no suction dredges reported for 1942–45.
[5] Includes all placer operations using power excavator and washing plant, both on dry land; when washing plant is movable, outfit is termed "dry-land dredge."
[6] Includes all operations in which hand labor is principal factor in delivering gravel to sluices, long toms dip boxes, pans, etc.
[7] Quantity not reported.
[8] Average excludes small-scale hand methods for which quantity of material treated was not reported.

Gold.—Although the level of gold production in Oregon in 1945 was approximately three times that in 1944, the monthly rate of output during the latter half of the year was much higher than the average for the entire year. Uncurtailed production was limited to the six-month period following the revocation of War Production Board Limitation Order L–208. A glance at the monthly production figures in the accompanying table shows the marked break at mid-year followed by a rise in output that greatly increased in the last quarter. Placer mining was the quicker to resume operations, lode mining being held back because of the narrower margin of profit between the fixed price for gold and the higher costs of operation. Connected-bucket dredge operations, inactive since 1942, accounted for 94 percent of the placer gold and 84 percent of the total gold produced in Oregon in 1945. All of the lode gold came from siliceous ores, and most of this ore was valued chiefly for gold. There were 19 Oregon properties producing in 1945—9 lode mines and 10 placers.

Mine production of gold and silver in Oregon in 1945, by months, in fine ounces, in terms of recovered metal

Month	Gold	Silver	Month	Gold	Silver
January	84	36	August	347	608
February	40	10	September	375	428
March	79	1,236	October	892	160
April	57	6,954	November	1,138	374
May	94	12	December	963	266
June	52	7			
July	346	370	Total	4,467	10,461

Silver.—Silver production in Oregon in 1945 was half the total for 1944. Jefferson County again, as in 1944, yielded over 80 percent of the State total. Dry silver ore was the principal source of silver, and the direct smelting of ore was the principal method of recovery. The monthly production figures show minor output during the first half of 1945 with the exception of March and April, during which time one property, subsequently inactive, accounted for the bulk of the output. Production during the last 6 months, although erratic, was on a generally higher level, roughly paralleling the increase in gold output.

Copper, lead, and zinc.—No copper, lead, or zinc mines were in operation in 1945 in Oregon. The recovery of these metals, totaling only 2,000 pounds in each case, was from siliceous ore mined chiefly for the gold and silver content. The recovery of zinc was the first since 1937.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, and lead in Oregon in 1945, by counties, in terms of recovered metals

County	Mines producing [1]		Gold					
	Lode	Placer	Lode		Placer		Total	
			Fine ounces	Value	Fine ounces	Value	Fine ounces	Value
Baker	3	2	179	$6,265	2,961	$103,635	3,140	$109,900
Curry	1		81	2,835			81	2,835
Grant		1			830	29,050	830	29,050
Jackson	1	1	59	2,065	76	2,660	135	4,725
Jefferson and Lane [2]	3		148	5,180			148	5,180
Josephine	1	6	14	490	119	4,165	133	4,655
	9	10	481	16,835	3,986	139,510	4,467	156,345
Total, 1944	13	10	1,076	37,660	293	10,255	1,369	47,915

County	Silver (lode and placer) [3]		Copper		Lead		Zinc		Total value
	Fine ounces	Value	Pounds	Value	Pounds	Value	Pounds	Value	
Baker	1,613	$1,147							$111,047
Curry	14	10							2,845
Grant	75	53							29,103
Jackson	24	17							4,742
Jefferson and Lane [2]	8,716	6,198	2,000	$270	2,000	$172	2,000	$230	12,050
Josephine	19	14							4,669
	10,461	7,439	2,000	270	2,000	172	2,000	230	164,456
Total, 1944	20,243	14,395	6,000	810	8,000	640			63,760

[1] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[2] Combined to avoid disclosure of individual outputs.
[3] Sources of total silver as follows—1945: 9,672 ounces from lode mines and 789 ounces from placers; 1944: 20,205 ounces from lode mines and 38 ounces from placers.

MINING INDUSTRY

Of the 1,378 tons of ore sold or treated in Oregon in 1945, Baker County produced 1,015 tons or 74 percent. Jefferson and Lane, of the other producing Counties, each produced more than 100 tons, but the total of the two Counties was only 16 percent. Of the total ore from the State, 91 percent was dry gold ore, the remainder being dry silver ore.

The three properties worked by connected-bucket dredges had one dredge each. All dredges commenced working after July 1, 1945, in the same locality as before the war, and none was moved elsewhere during the year. No dragline dredge or nonfloating washing plant to which gravel was delivered by mechanical means was reported in operation in 1945. Of the five properties worked by hydraulic methods, one reported the use of two hydraulic giants and another property reported six monitors in use. Reports on the use of quicksilver at Oregon placer mines indicate that only 161 pounds was consumed at seven properties, dredge and hydraulic, that submitted data on quicksilver. The two connected-bucket dredges reporting consumption of quicksilver in 1945 recovered 24 ounces of gold for each pound of quicksilver used, compared with 37 ounces in 1942, the previous operating year. Five hydraulic mines reported the consumption of 21 pounds of quicksilver, or 1 pound per each 8 ounces of gold recovered in 1945, compared with 1 pound of quicksilver for each 33 ounces of gold recovered at hydraulic operations in 1944.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore and old tailings sold or treated in Oregon in 1945, with content in terms of recovered metals

Source	Material sold or treated		Gold	Silver	Copper	Lead	Zinc
	Ore	Old tailings					
	Short tons	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold ore	1,258		443	1,229	2,000	2,000	2,000
Dry and siliceous silver ore	120		38	8,443			
Total, lode mines	1,378		481	9,672	2,000	2,000	2,000
Total, placers			3,986	789			
	1,378		4,467	10,461	2,000	2,000	2,000
Total, 1944	3,217	1,000	1,369	20,243	6,000	8,000	

METALLURGIC INDUSTRY

Of the State total ore (1,378 tons), 48 percent was treated in amalgamation mills with or without concentrating equipment, 47 percent was shipped crude to smelters; and 5 percent was treated in cyanidation mills without concentration. Ultimate recovery of 53 percent of the total lode gold was from direct smelting of ore; 21 percent was as bullion from the amalgamation of ore; 17 percent was as bullion from the cyanidation of ore; and 9 percent was recovered by the smelting of flotation concentrates produced at amalgamation mills. Of the total lode silver recovered, 91 percent came from direct smelting of ore, and most of the remainder by the smelting of flotation concentrates. All material requiring smelting was shipped out of the State, as Oregon has no smelters. No data are available covering quicksilver or cyanide consumption at Oregon mills in 1945.

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Mine production of metals in Oregon in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Ore amalgamated	669	102	32			
Ore cyanided	66	81	14			
Concentrates smelted: Flotation	21	43	869			
Ore smelted	643	255	8,757	2,000	2,000	2,000
Total, lode mines		481	9,672	2,000	2,000	2,000
Total, placers		3,986	789			
		4,467	10,461	2,000	2,000	2,000
Total, 1944		1,369	20,243	6,000	8,000	

Mine production of metals from amalgamation and cyanidation mills (with or without concentration equipment) in Oregon in 1945, by types of mills and by counties, in terms of recovered metals

AMALGAMATION MILLS

County	Material treated		Recovered in bullion		Concentrates smelted and recovered metal		
	Ore	Old tailings	Gold	Silver	Concentrates produced	Gold	Silver
	Short tons	*Shor tons*	*Fine ounces*	*Fine ounces*	*Short tons*	*Fine ounces*	*Fine ounces*
Baker	598		29	17	21	43	869
Jackson	1		59	10			
Josephine	70		14	5			
	669		102	32	21	43	869
Total, 1944	425		129	47			
CYANIDATION MILLS							
Curry	66		81	14			
	66		81	14			
Total, 1944	84	1,000	209	851			
Grand total: 1945	735		183	46	21	43	869
1944	509	1,000	338	898			

Gross metal content of concentrates produced from ores mined in Oregon in 1945, by classes of concentrates

Class of concentrates	Concentrates	Gross metal content				
		Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry gold	21	43	869			
	21	43	869			
Total, 1944	91	37	4,459	2,198	6,054	

Mine production of metals from Oregon concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates	Gold	Silver	Copper	Lead
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*
Baker	21	43	869		
	21	43	869		
Total, 1944	91	37	4,459	2,000	3,000

BY CLASSES OF CONCENTRATES

Dry gold	21	43	869		
	21	43	869		

Gross metal content of Oregon crude ore shipped to smelters in 1945, by classes of ore

Class of material	Material shipped [1]	Gross metal content				
	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Dry and siliceous gold and dry and siliceous silver [2]	643	255	8,757	2,862	3,378	2,667
	643	255	8,757	2,862	3,378	2,667
Total, 1944	1,783	701	14,848	5,003	11,193	

[1] No old tailings shipped to smelters in 1945 or 1944.
[2] Combined to avoid disclosure of individual outputs.

Mine production of metals from Oregon crude ore shipped to smelters in 1945,[1] in terms of recovered metals

BY COUNTIES

	Ore	Gold	Silver	Copper	Lead	Zinc
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*
Baker	417	107	41			
Jefferson and Lane [2]	226	148	8,716	2,000	2,000	2,000
	643	255	8,757	2,000	2,000	2,000
Total, 1944	1,783	701	14,848	4,000	5,000	

BY CLASSES OF ORE

Dry and siliceous gold and dry and siliceous silver [2]	643	255	8,757	2,000	2,000	2,000

[1] No old tailings shipped to smelters in 1945 or 1944.
[2] Combined to avoid disclosure of individual outputs.

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Oregon in 1945, by counties and districts, in terms of recovered metals [1]

County and district [1]	Mines producing [2]		Ore	Gold			Silver (lode and placer) [3]	Copper	Lead	Zinc	Total value
	Lode	Placer		Lode	Placer	Total					
Baker County:			*Short tons*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Fine ounces*	*Pounds*	*Pounds*	*Pounds*	
Cracker Creek	1		585	59		59	898				$2,704
Greenhorn		1			404	404	86				14,201
Sumpter		1			2,557	2,557	600				89,922
Weatherby	1		13	11		11	3				387
Curry County: Chetco	1		66	81		81	14				2,845
Grant County:											
Canyon		1			827	827	73				28,997
Unallocated		(4)			3	3	2				106
Jackson County:											
Gold Hill	1	(4)	1	59	6	65	11				2,283
Upper Applegate		1			63	63	10				2,212
Unallocated		(4)			7	7	3				247
Josephine County:											
Greenback		2			74	74	10				2,597
Illinois River		1			13	13	1				456
Waldo	1	2	70	14	30	44	8				1,546
Combined counties and districts [5]	4	1	643	257	2	259	8,742	2,000	2,000	2,000	15,953
Total, Oregon	9	10	1,378	481	3,986	4,467	10,461	2,000	2,000	2,000	164,456

[1] Only those counties and districts shown separately for which Bureau of Mines is at liberty to publish figures; others producing listed in footnote 5 and their output included under "Combined counties and districts."
[2] Excludes itinerant prospectors, snipers, high-graders, and others who gave no evidence of legal right to property.
[3] Source of total silver as follows: 9,672 ounces from lode mines, 789 ounces from placers.
[4] Output from a property not classed as a "mine."
[5] Includes following districts: Virtue in Baker County; Ashwood in Jefferson County; Grants Pass in Josephine County; and Bohemia in Lane County.

BAKER COUNTY

Cracker Creek district.—Bald Mountain Mine operated the Bald Mountain mine throughout 1945; the mill operated 2 months. Part of the gold output was recovered by amalgamation. The remainder was recovered from flotation concentrates produced at a newly installed plant and a minor quantity of smelting ore; the flotation product and the ore were shipped to a smelter.

Greenhorn district.—The Sunshine Mining Co. (Burnt River Division) resumed operation of its Yuba electric connected-bucket dredge with 72 4½-cubic foot buckets on October 16, 1945. Operation had been suspended in October 1942 as a result of the War Production Board Limitation Order L-208. The gravel treated during 2½ months in 1945 yielded 404 ounces of gold and 86 ounces of silver.

Sumpter district.—The Sumpter Valley Dredging Co., the largest producer of gold in Oregon in 1945, resumed operation of its Yuba electric connected-bucket dredge with 72 9-cubic foot buckets on July 5 following a period of idleness since October 31, 1942. Treatment of 1,143,616 cubic yards of gravel from the property, which is on the Powder River near Sumpter, yielded 2,543 ounces of gold and 596 ounces of silver.

Virtue district.—Anthony Bradenthaler shipped 416 tons of antimony ore from the Gray Eagle mine; the ore contained 106 ounces of gold and 26 ounces of silver.

Weatherby district.—A. V. Lovejoy recovered 11 ounces of gold and 3 ounces of silver from 13 tons of ore produced at the Lovejoy (Gleason) mine, which was operated intermittently from June 1 to December 31.

CURRY COUNTY

Chetco district.—The Robert E. mine was operated by W. D. Bowser throughout 1945; 66 tons of ore cyanided yielded 81 ounces of gold and 13 ounces of silver.

GRANT COUNTY

Canyon district.—The Western Gold Dredging Co. resumed operation of its connected-bucket dredge on John Day River August 26 following a period of inactivity since October 13, 1942. The dredge has 72 6-cubic foot buckets.

JACKSON COUNTY

Gold Hill district.—John H. Mardon amalgamated a small quantity of ore in 1945 from the Sunrise mine from which 59 ounces of gold and 10 ounces of silver were recovered.

Upper Applegate district.—George and William Lewis and Paul Pearce hydraulicked 12,000 cubic yards of gravel at the Sterling mine between January 1 and July 15, 1945, and recovered 63 ounces of gold and 10 ounces of silver.

JEFFERSON COUNTY

Ashwood district.—The Oregon King mine was in operation during the first part of 1945; silver ore was shipped for direct smelting. The property, located on Trout Creek, was the State's largest producer of silver in 1945 despite the short productive period.

JOSEPHINE COUNTY

Greenback district.—M. H. Davis carried on hydraulicking operations at the Blue Channel mine from January 1 to April 15 in 1945. The Goff mine was operated by hydraulic methods from March 1 to April 30 by C. C. Clark.

Illinois River district.—Harry H. McGrath hydraulicked 1,500 cubic yards of gravel at the Frances mine on Josephine Creek between January 1 and June 1, 1945, and recovered 13 ounces of gold and 1 ounce of silver.

Waldo district.—Ben Baker operated the Blanket Ledge mine on Green's Creek from July 1 to October 20, 1945; 70 tons of ore were milled, from which 14 ounces of gold and 5 ounces of silver were recovered by amalgamation. Hydraulicking at the Esterley mine by R. F. Oliphant during 1945 yielded 20 ounces of gold and 2 ounces of silver from washing 2,025 cubic yards of gravel.

LANE COUNTY

Bohemia district.—The Evening Star mine was operated by Fred J. Bartel for a short period late in 1945; gold ore containing a small quantity of base metal was shipped to a smelter for direct treatment. The Silver Shield Mining & Milling Co. operated the Noonday mine, near Disston, during the later months of 1945. Gold ore was shipped to smelters for treatment. In addition to gold and silver, small quantities of copper, lead, and zinc were recovered. The production of zinc in 1945 from the Bohemia district was the only reported instance of recovery of this metal from Oregon since 1937, when smelter payments were made for zinc in ore from the same district.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN SOUTH DAKOTA

(MINE REPORT)

By G. E. Woodward

SUMMARY OUTLINE

SUMMARY

Lode gold mining, the principal source of mineral revenue in South Dakota, was at a standstill in 1945 until War Production Board Limitation Order L–208 was rescinded on July 1. With lifting of this restriction only the Homestake Mining Co. at Lead and the Bald Mountain Mining Co. at Trojan, both in Lawrence County, resumed operations. Neither company, however, was able to attain full-scale operations due chiefly to a shortage of labor. Some difficulties were experienced in reopening stopes, but at the end of the year both companies were operating at about 50-percent capacity. The output of recovered gold in South Dakota was 55,948 fine ounces valued at $1,958,180 compared with 11,621 ounces valued at $406,735 in 1944. The output of silver, a byproduct of gold mining, was 26,564 fine ounces valued at $18,890 compared with 5,445 ounces valued at $3,872 in 1944. There was no production of copper, lead, or zinc in 1945.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

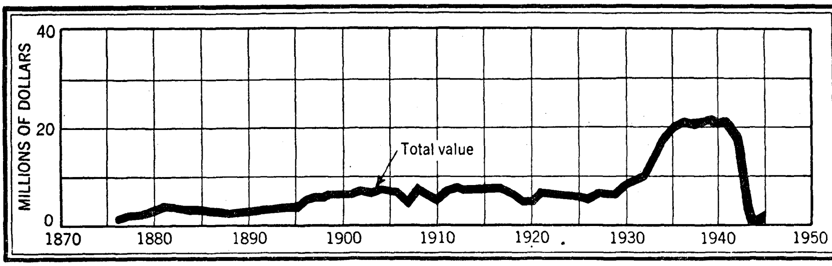

FIGURE 1.—Total value of mine production of gold and silver in South Dakota, 1876–1945.

Mine production of gold, silver, copper, lead, and zinc in South Dakota, 1941–45, and total, 1876–1945, in terms of recovered metals [1]

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	10	41	1,711,744	600,637	$21,022,295	170,771	$121,437
1942	5	13	1,464,384	522,098	18,273,430	186,937	132,933
1943	3		204,932	106,444	3,725,540	35,886	25,519
1944	2		2,839	11,621	406,735	5,445	3,872
1945	3		312,612	55,948	1,958,180	26,564	18,890
1876–1945			(2)	20,734,054	507,289,099	9,601,108	6,829,842

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941							$21,143,732
1942	2,000	$242	170,000	$11,390	230,000	$21,390	18,439,385
1943			82,000	6,150	92,000	9,936	3,767,145
1944	2,000	270	68,000	5,440	112,000	12,768	429,085
1945							1,977,070
1876–1945	[3] 106	36,466	[3] 455	58,500	[3] 217	44,094	514,258,001

[1] For total production of gold and silver in South Dakota, by years, see Mineral Resources, 1913, pt. 1, p. 42; Mineral Resources, 1922, pt. 1, p. 194; and subsequent volumes of Mineral Resources and Minerals Yearbook.
[2] Figures not available.
[3] Short tons.

Gold and silver produced at placer mines in South Dakota, 1941–45, in terms of recovered metals

Year	Gold		Silver		Total value
	Fine ounces	Value	Fine ounces	Value	
1941	93	$3,255	7	$5	$3,260
1942	33	1,155	3	2	1,157
1943–45					

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in South Dakota in 1945, by counties, in terms of recovered metals

County	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
Lawrence	2	----------	312,610	55,947	$1,958,145	26,564	$18,890
Pennington	1	----------	2	1	35	----------	----------
	3	----------	312,612	55,948	1,958,180	26,564	18,890
Total, 1944	2	----------	2,839	11,621	406,735	5,445	3,872

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Lawrence	----------	----------	----------	----------	----------	----------	$1,977,035
Pennington	----------	----------	----------	----------	----------	----------	35
	----------	----------	----------	----------	----------	----------	1,977,070
Total, 1944	2,000	$270	68,000	$5,440	112,000	$12,768	429,085

MINING AND METALLURGIC INDUSTRY

The total ore mined and treated by producers of lode gold and silver in South Dakota in 1945 was 312,612 tons, yielding in recovered metals 55,948 fine ounces of gold and 26,564 fine ounces of silver. No copper, lead, or zinc was produced; all ore mined was dry and siliceous gold ore containing no economically recoverable base metal. A break-down by methods of treatment shows that 298,828 tons of ore, yielding 53,498 ounces of gold and 12,583 ounces of silver, were treated by amalgamation followed by separate cyanidation of sands and slimes; 13,782 tons, yielding 2,449 ounces of gold and 13,981 ounces of silver, were treated by cyanidation only; and 2 tons of ore, yielding 1 ounce of gold, were treated by amalgamation only.

No recovery of metals was made from placer operations.

METALLURGIC RECOVERY

Gold and silver bullion produced at mills in South Dakota by amalgamation, 1941–45

Year	Ore treated	Gold in bullion	Silver in bullion	Quicksilver used
	Short tons	*Fine ounces*	*Fine ounces*	*Pounds*
1941	1,506,183	328,166.44	62,423	6,537
1942	1,275,138	276,298.00	56,852	3,561
1943	183,246	69,710.02	13,640	508
1944	----------	----------	----------	----------
1945	298,830	35,398.00	7,254	1,500

Gold and silver bullion produced at mills in South Dakota by cyanidation, 1941–45

Year	Material treated				Gold in bullion product	Silver in bullion product	Sodium cyanide used [1]
	Crude ore	Concentrates	Sands and slimes	Total			
	Short tons	*Short tons*	*Short tons*	*Short tons*	*Fine ounces*	*Fine ounces*	*Pounds*
1941	205,356		1,499,000	1,704,356	270,989.89	106,437	903,680
1942	161,635	[2] 366	1,271,305	1,433,306	244,421.00	122,312	801,478
1943	18,772		178,318	197,090	36,679.00	19,048	149,326
1944							
1945	13,782		237,503	251,285	20,550.00	19,310	[3] 109,900

[1] In terms of 96- to 98-percent strength.
[2] From 17,614 tons of crude ore treated by table and jig concentration.
[3] Includes 217,952 pounds of calcium cyanide (48- to 49-percent strength); all reduced to equivalent of 96- to 98-percent strength to conform with earlier use of figures for high-strength NaCN and KCN.

REVIEW BY COUNTIES

LAWRENCE COUNTY

Homestake mine.—The Homestake Mining Co. resumed operation of its Homestake mine July 2, 1945, after a shut down, except for maintenance work, since June 8, 1943 (the last ore was hoisted from the mine May 26, 1943). Operation of the mill units was started July 9, and the first bullion produced was shipped August 8, 1945. An average of 1,700 tons of ore per day was treated during the remainder of the year—capacity of the plant is about 3,900 tons a day. The annual report of the general manager of the Homestake Mining Co. for the year ended December 31, 1945, says—

On June 16, 1945, word was received that Order L–208 of the War Production Board, under which operations of the gold mines in the United States had been suspended in 1942, was rescinded effective July 1, 1945. Plans were made for immediate resumption of production. Work in the mine began on Monday, July 2, 1945, and milling on a small scale was resumed one week later.

During the balance of the year 298,828 tons of ore were milled from which bullion worth $1,873,872.64 was produced. The indicated recoverable grade of $6.27 per ton is low on account of the necessity of obtaining the major part of the ore from caving operations on the upper levels where maximum tonnage could be mined with the men available. Tons milled increased from 12,119 in July to 64,404 in December with a corresponding rise in value of bullion from $25,318.86 to $652,263.85.

The mine and plant had been maintained in full readiness for resumption of operations and the rate of increase in production was limited only by the technical problems of getting stopes into operation after the extended shut-down and by the number of men to break ore in them.

All effort during the last half of the year was centered on production. No diamond drilling was done nor was any drifting or raising undertaken except for raises and short extensions of drifts necessary for stoping.

The reserve of developed ore is 18,979,000 tons. This includes 167,000 tons of broken ore in shrinkage stopes which is greater by 75,000 tons than the amount of broken ore on hand when operations were resumed.

Production of materials essential to the war effort in the machine shop and foundry continued until the end of the war. Most contracts were terminated soon after V-J Day and conversion to our normal operations proceeded very rapidly.

Production of lumber and timber from our sawmill at Spearfish, S. Dak., was normal. Approximately 82 percent of production was sold commercially. After V-J Day production of mine timber was gradually increased to meet our own needs.

Output of coal from the Wyodak mine was low during the first part of the year but grew steadily in the last half of the year both because of the greater demand in our own power plant at Homestake and because of larger outside sales. Results for the year were satisfactory.

Four hundred eleven more men were on the payrolls at the end of the year than in June. Of the 498 former employees who had joined the armed services, 165 have returned, and in addition 124 World War II veterans not previously with the company have been hired.

Ore milled, receipts, and dividends, Homestake mine, 1941–45 [1]

Year	Ore milled (short tons)	Receipts for bullion product		Dividends
		Total	Per ton	
1941	1,499,988	$19,529,080.70	$13.0195	$9,041,760
1942	1,275,138	17,068,437.84	13.3856	7,534,800
1943	183,246	3,629,507.33	19.8067	
1944	(2)	402,591.29	(2)	
1945	298,828	1,873,872.64	6.2707	

1 From 1876 to 1945, inclusive, this mine yielded bullion and concentrates that brought a net return of $441,516,237 and paid $149,805,802 in dividends.

2 No ore milled; bullion product recovered in clean-up of launders, pipe lines, mill liners, and other machinery during course of mill maintenance.

Other mines.—The Bald Mountain Mining Co. began rehabilitation of its properties at Trojan on July 1, 1945, and began milling operations in its 350-ton all-sliming counter-current-cyanidation plant, also at Trojan, September 20, 1945. An average of 134 tons of ore per day was treated during the remainder of the year. The company mined only oxide ores and did not operate its 110-ton, gas-fired, rotary hearth furnace. The company did no development in 1945. The Belle Eldridge Gold Mines, Inc., at Deadwood, in 1945 performed development only in the mine (1,191 feet of drifts and 2,835 feet of diamond drilling) and made some changes in its 50-ton selective-flotation mill adding jig, amalgamation, and cyanidation equipment.

PENNINGTON COUNTY

R. E. Nelson and James A. Murphy recovered 1 ounce of gold by amalgamation in the process of cleaning out a cave-in in their Western Bell and James Lode mining properties near Hill City.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN TEXAS

(MINE REPORT)

By S. A. Gustavson

SUMMARY OUTLINE

SUMMARY

Mines in Texas produced (in terms of recovered metals) 23,265 fine ounces of silver and 110,000 pounds of copper in 1945, compared with 5,355 ounces of silver and 230,000 pounds of copper in 1944. No gold or lead has been produced in the State since 1943 and no zinc since 1917.

Four mines accounted for all of the 1945 output—three in Hudspeth County and one in Culberson County. All ore was shipped without concentration to the copper smelter at El Paso.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

MINE PRODUCTION

The following table shows the annual output of ore and the quantity and value of the metals recovered from Texas mines from 1941 to 1945, as well as the total metal production from 1885 to 1945.

Mine production of gold, silver, copper, lead, and zinc in Texas, 1941–45, and total, 1885–1945, in terms of recovered metals

Year	Ore (short tons)	Gold		Silver	
		Fine ounces	Value	Fine ounces	Value
1941	140, 818	306	$10, 710	1, 096, 027	$779, 397
1942	100, 698	236	8, 260	672, 781	478, 422
1943	4, 134	4	140	10, 284	7, 313
1944	4, 160			5, 355	3, 808
1945	2, 693			23. 265	16, 544
1885–1945	(1)	8, 281	223, 780	33, 225, 441	23, 380, 380

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	12, 000	$1, 416	372, 000	$21, 204			$812, 727
1942	198, 000	23, 958	362, 000	24, 254			534, 894
1943	162, 000	21, 060	26, 000	1, 950			30, 463
1944	230, 000	31, 050					34, 858
1945	110, 000	14, 850					31, 394
1885–1945	[2] 1, 306	369, 071	[2] 4, 788	489, 449	[2] 744	$106, 491	24, 569, 171

[1] Figures not available.

[2] Short tons.

Mine production of silver and copper in Texas in 1945, by counties, in terms of recovered metals

County	Mines producing	Ore (short tons)	Silver (fine ounces)	Copper (pounds)
Culberson	1	397	1, 963	13, 000
Hudspeth	3	2, 296	21, 302	97, 000
	4	2, 693	23, 265	110, 000
Total, 1944	3	4, 160	5, 355	230, 000

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Texas in 1945, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Silver (fine ounces)	Copper (pounds)
Dry and siliceous silver ore	3	1, 093	22, 857	22, 000
Copper ore	1	1, 600	408	88, 000
	4	2, 693	23, 265	110, 000
Total, 1944	3	4, 160	5, 355	230, 000

SMELTING AND REFINING PLANTS IN TEXAS

Texas has in its smelting industry a capacity for the reduction of ores and concentrates containing gold, silver, copper, lead, and zinc far beyond the capacity of its mines and mills to produce them. The industry shows a diversity of smelter products that is equaled only by Montana among the western States. Texas smelters provide a market for ores and concentrates from mines chiefly in the nearby western States of New Mexico, Arizona, and Colorado and from mines in foreign countries of the Western Hemisphere; a substantial quantity of smelter residue is treated from other sections of the United States. The industry has abundant supplies of natural gas available as fuel.

In 1945 the smelters and refineries within the State had capacity for producing 114,000 tons of slab zinc and 240,000 tons of refined copper. Lead smelters had capacity for treatment of 250,000 tons of ores and concentrates. Copper smelter capacity was 600,000 tons of ores and concentrates. Gold and silver ores were absorbed at both lead and copper smelters as flux.

The smelting industry in 1945 was beset by a shortage of skilled workers; generally, however, the zinc reduction plants at Dumas and Amarillo were affected most seriously. These zinc plants were able to produce at far less than capacity; the rate at Dumas was less than one-third. The lead plant at El Paso and the electrolytic zinc plant at Corpus Christi, however, maintained capacity operations throughout the year. The copper smelter at El Paso was operated at less than capacity, mostly due to insufficient supply of ores and concentrates, and the copper refinery was operated at about 65 percent of capacity.

The lead and copper smelters in El Paso, owned by the American Smelting & Refining Co., operated throughout 1945. The lead plant consisted of two blast furnaces having a total capacity of 250,000 tons of charge annually. Ores and concentrates were supplied domestically by operators in Arizona and New Mexico; material received from operators in Mexico, Argentina, Canada, Newfoundland, French Equatorial Africa, and Australia contributed materially to the plant intake. The copper plant consists of two reverberatory furnaces and three converters having a total annual capacity of 600,000 tons of charge. In 1945 ores and concentrates were supplied domestically by operators in Arizona, New Mexico, Texas, and Utah, and foreign material was received from Mexico and Newfoundland. Both the lead and copper plants also treated residues from other smelting plants.

The zinc-smelting component of the Texas smelting industry is made up of three reduction plants—two horizontal retort plants and one electrolytic plant. The American Smelting & Refining Co. operated its gas-fired horizontal zinc retort plant at Amarillo throughout the year but at a greatly reduced capacity, because primarily of a shortage of skilled smelter workers. The plant is equipped with eight furnaces having a total of 6,400 horizontal retorts and has an annual capacity for producing 36,000 tons of zinc metal. In 1945 only minor improvements were made at the plant. The Metals Reserve Company maintains a stock pile of concentrates at the plant.

Concentrates were received from operators in Arizona, Colorado, Montana, Nevada, New Mexico, and Utah. The American Zinc Co. of Illinois operated its gas-fired horizontal-retort zinc smelter at Dumas throughout the year. The plant is equipped with eight furnaces having a total of 6,656 retorts and can produce 48,000 tons of zinc metal annually. A stock pile of zinc concentrates is maintained at the plant by the Metals Reserve Company. In 1945 concentrates were purchased from operators in Arizona, Colorado, Idaho, New Mexico, Utah, and Mexico. No major additions or improvements were made at the plant in 1945.

Electrolytic zinc was produced throughout 1945 by the American Smelting & Refining Co. at its Corpus Christi plant, which has an annual production capacity of 31,200 tons of cathode zinc. The bulk of the 1945 output was obtained from the reduction of Mexican concentrates; some concentrates of domestic origin were received from operators in Arizona and New Mexico.

The Phelps Dodge Corp. operated its copper refinery in El Paso at about 65 percent of its rated capacity of 240,000 tons of copper cathodes annually. No additions were made to the plant in 1945, and improvements were confined to operating efficiency. The corporation produced both electrolytic and fire-refined copper and received most of the blister copper for refining from its Arizona smelters at Clarkdale, Douglas, and Morenci.

REVIEW BY COUNTIES

Culberson County.—A. P. Williams operated the Hazel mine near the Culberson-Hudspeth County line 14 miles northwest of Van Horn. A total of 397 tons of dry silver ore containing 1,963 ounces of silver and 13,732 pounds of copper was shipped to the El Paso copper smelter from March through June.

Hudspeth County.—The Black Shaft mine in the Carrizo Mountains 9 miles northeast of Allamoore was operated throughout 1945 by M. F. Drunzer; a total of 1,600 tons of copper ore containing 408 ounces of silver and 90,550 pounds of copper was produced. M. F. Drunzer also made two shipments of dry silver ore from the Garren Lease on the Sancho Panza property 7 miles northeast of Allamoore, which totaled 86 tons and contained 1,347 ounces of silver and 1,000 pounds of copper. M. F. Drunzer and H. E. Stumberg operated the Hackberry mine and shipped 610 tons of dry silver ore containing 19,547 ounces of silver and 8,633 pounds of copper. All ore shipped from Hudspeth County went to the El Paso copper smelter.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN UTAH

(MINE REPORT)

By C. E. Needham and Paul Luff

SUMMARY OUTLINE

SUMMARY

The output of gold, silver, copper, lead, and zinc in Utah continued to decline during 1945, and in spite of slightly higher average prices for lead and zinc the value of the five metals decreased 19 percent, from $111,036,247 in 1944 to $90,018,641 in 1945. Copper furnished nearly 68 percent of the total value, gold 11, zinc nearly 9, lead 8, and silver nearly 5 percent. Comparing quantities of metals produced in 1945 with 1944, lead showed the largest decline (22 percent), but the rise in lead price reduced its percentage decrease in value below the average for the five metals. Although declines were general in all the more important districts, the total value of the five metals produced in the State exceeded that of any State except Arizona. Compared with 1944, the value of the five metals produced in the West Mountain (Bingham) district in 1945 declined 20 percent; Park City region, 20 percent; and Tintic district, less than 1 percent. The Utah Copper Co. continued to supply most of the value of the State metal production.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Utah, 1941–45, and total, 1864–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	167	12	31, 952, 817	356, 501	$12, 477, 535	11, 395, 485	$8, 103, 456
1942	123	6	34, 981, 655	391, 544	13, 704, 040	10, 574, 955	7, 519, 968
1943	110	1	37, 386, 731	390, 470	13, 666, 450	9, 479, 340	6, 740, 864
1944	97		30, 940, 205	344, 223	12, 047, 805	7, 593, 075	5, 399, 520
1945	89		24, 723, 184	279, 979	9, 799, 265	6, 106, 545	4, 342, 432
1864–1945			(1)	10, 464, 445	266, 480, 615	715, 054, 066	520, 758, 052

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	533, 676, 000	$62, 973, 768	139, 202, 000	$7, 934, 514	84, 098, 000	$6, 307, 350	$97, 796, 623
1942	613, 382, 000	74, 219, 222	143, 860, 000	9, 638, 620	91, 086, 000	8, 470, 998	113, 552, 848
1943	647, 978, 000	84, 237, 140	130, 514, 000	9, 788, 550	93, 792, 000	10, 129, 536	124, 562, 540
1944	565, 150, 000	76, 295, 250	105, 038, 000	8, 403, 040	77, 988, 000	8, 890, 632	111, 036, 247
1945	452, 752, 000	61, 121, 520	81, 634, 000	7, 020, 524	67, 260, 000	7, 734, 900	90, 018, 641
1864–1945	[2] 4, 786, 157	1,335,362,473	[2] 4, 388, 329	482, 562, 576	[2] 954, 719	131, 068, 693	2, 736, 232, 409

[1] 1864–1901: Figures not available; 1902–45: 549,397,758 tons produced. [2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Utah in 1945, by months, in terms of recovered metals

Month	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	22, 260	498, 194	38, 904, 000	7, 528, 000	6, 016, 000
February	22, 749	505, 123	36, 936, 000	7, 204, 000	6, 024, 000
March	23, 640	519, 854	39, 520, 000	7, 562, 000	6, 602, 000
April	24, 409	520, 085	39, 658, 000	7, 224, 000	5, 972, 000
May	25, 220	613, 471	41, 936, 000	8, 028, 000	5, 986, 000
June	25, 606	561, 811	39, 626, 000	7, 516, 000	5, 968, 000
July	24, 947	488, 550	41, 246, 000	5, 370, 000	4, 900, 000
August	22, 405	501, 686	38, 406, 000	6, 330, 000	4, 916, 000
September	23, 102	489, 956	38, 016, 000	6, 148, 000	4, 912, 000
October	23, 954	477, 272	36, 078, 000	5, 980, 000	4, 964, 000
November	20, 945	480, 274	31, 912, 000	6, 422, 000	5, 474, 000
December	20, 742	450, 269	30, 514, 000	6, 322, 000	5, 526, 000
	279, 979	6, 106, 545	452, 752, 000	81, 634, 000	67, 260, 000
Total, 1944	344, 223	7, 593, 075	565, 150, 000	105, 038, 000	77, 988, 000

Gold.—Utah retained its position as the leading gold-producing State in 1945, but gold output decreased 19 percent from that in 1944. Gold mining as such remained at a low level in 1945, and over 92 percent of the State total gold output was derived from copper ore and zinc-lead ore; most of the remainder came from siliceous ores. No placers were active in 1945.

In 1945, the West Mountain (Bingham) district was again the leading gold-producing area in the United States, but it experienced a drop of 20 percent from 312,493 ounces in 1944 to 248,570 ounces in 1945. Each of the major gold-producing mines in the district contributed to the loss in output.

The Tintic district forged ahead of the Park City region in 1945 to become second to the West Mountain (Bingham) district in gold production. Output rose from 11,417 ounces in 1944 to 14,536 ounces in 1945, a 27-percent gain. The increase resulted largely from higher-grade ore produced from the Tintic Bullion mine. The Tintic district was the source of most of the siliceous ores produced in the State in 1945, of which the greater part was used as flux at the Garfield and Tooele reverberatory copper smelters.

Production of gold held up well in 1945 in the Park City region, which ranked third in State gold output; the output declined only 9 percent, from 15,149 ounces in 1944 to 13,822 ounces in 1945. Most of the decrease resulted from reduced tonnage of zinc-lead ore from the New Park property.

The Utah Copper Co. produced 20 percent less gold in 1945 than in 1944, yet none of the large prewar gold mines in the country were able to increase production enough, following revocation of War Production Board Order L-208 July 1, 1945, to displace the Utah Copper Co. as the Nation's leading gold producer. Following the Utah Copper Co. in State gold output, in the order named, were the United States & Lark group (zinc-lead ore) in the West Mountain (Bingham) district, the New Park property (zinc-lead ore) in the Park City region, the Tintic Bullion mine (gold ore) and the Tintic Standard property (gold-silver ore and lead ore) in the Tintic district, the Niagara mine (zinc-lead ore) in the West Mountain (Bingham) district, the Eureka Lilly mine (gold-silver ore) in the Tintic district, the Boston Consolidated property (copper ore) and the

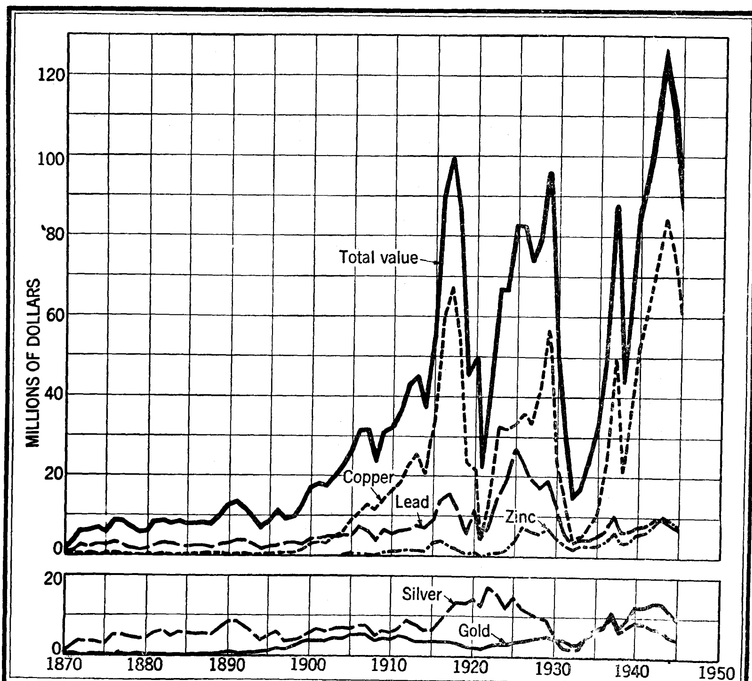

FIGURE 1.—Value of mine production of gold, silver, copper, lead, and zinc, and total value in Utah, 1870–1945.

National Tunnel & Mines Co. (copper ore and zinc-lead ore) in the West Mountain (Bingham) district, and the Calumet mine (zinc-lead ore) in the Rush Valley district. These 10 properties produced 97 percent of the State gold output in 1945.

Silver.—Of the three leading silver districts in Utah—West Mountain (Bingham), Tintic, and Park City—the first two showed declines in silver output in 1945 and the third recorded a small increase; the State output showed a reduction of 20 percent from 1944.

Although output in the West Mountain district slumped over 1,000,000 ounces in 1945 compared with 1944, the district supplied 59 percent of the State silver output. The decrease resulted from a smaller output from the two principal silver-producing mines in the district—the Utah Copper Co., and the United States & Lark properties. In the Tintic district, the second leading silver-producing area, substantial increases were recorded from the Tintic Standard and Chief Consolidated properties, but these gains were nearly offset by losses from the Harold dump, resulting in a net increase of only 16,221 ounces for the whole district. In the Park City region, the third leading silver-producing area in the State, output dropped 395,820 ounces (28 percent), owing to marked decreases at each of the three principal producers—Park Utah Consolidated, Silver King Coalition, and New Park.

Zinc-lead ore, zinc-ore, and lead ore together supplied 51 percent of the total silver in Utah in 1945, copper ore supplied 34 percent, and siliceous ores, 15 percent.

The Utah Copper Co. remained the leading silver producer in the State in 1945, but its output was nearly half a million ounces less than in 1944, owing to a decline in production of copper ore. It was followed by the United States & Lark property, which also showed a loss of nearly half a million ounces from 1944, because of a smaller output of zinc-lead ore. Other important producers of silver, in order of output, were the Tintic Standard, New Park, Park Utah Consolidated, Silver King Coalition, Chief Consolidated, Calumet, Godiva, and Butterfield properties. These 10 properties furnished 89 percent of the State total silver in 1945.

Copper.—The output of recoverable copper in Utah in 1945 dropped 20 percent below that in 1944 and was the lowest since 1939; yield was only 70 percent of that for the peak year 1943. With the exception of the Ohio Copper Co. operation in San Juan County, all the principal copper-producing operations showed a decline in 1945, the greatest being at the Utah Copper Co. property at Bingham. However, this property remained the leading copper mine in the United States.

Utah mines that yielded over a million pounds of recoverable copper each in 1945 included the Utah Copper Co. mine, the National Tunnel & Mines Co. property, the Columbia group of the Ohio Copper Co., the United States & Lark property, all in the West Mountain (Bingham) district, and the Big Indian property of the Ohio Copper Co. in the La Sal district in San Juan County. These five properties supplied 99 percent of the State output of copper.

Lead.—The principal lead-producing mines in Utah continued to be seriously handicapped by labor shortages in 1945. The labor situation, coupled with the fact that the mines worked only one shift a day, resulted in a 22-percent decline in State lead output from that in 1944. Production in 1945 was the lowest since 1899.

The West Mountain (Bingham) district showed a loss in lead output of nearly 17,000,000 pounds in 1945 from that in 1944, but it remained the chief source of lead in the State. Decreases were substantial at all the larger operations, but the slump was especially marked at the United States & Lark group—over 15,000,000 pounds. The Park City region ranked second in lead production but yielded only 76 percent as much as in 1944. Each of the larger producers in the region showed a decrease, the greatest being from the property of the Park Utah Consolidated Mining Co. Decline in lead output in 1945 from the Tintic district, the third leading source of lead in the State, was not so marked—only 7 percent. An increase of over 1,100,000 pounds of lead from the Tintic Standard property was more than offset by decreases from the Harold dump and the Chief Consolidated mine. A large supply of siliceous material containing 3 to 4 percent lead continued to be shipped from the Tintic district as flux for the copper smelters in the Salt Lake Valley area. The lead recovered from this material tended to compensate the losses at other properties in the district.

The United States & Lark group in the West Mountain (Bingham) district, operated by the United States Smelting, Refining & Mining Co., remained by far the largest producer of lead in the State. It was followed by the New Park and Park Utah Consolidated properties in the Park City region, the Calumet mine in the Rush Valley district, the Tintic Standard mine in the Tintic district, the Silver King Coalition mine in the Park City region, the Chief Consolidated mine in the Tintic district, the Montana-Bingham and the Butterfield properties at Bingham, and the Tooele slag-fuming plant in Tooele County. From these 10 operations came 98 percent of the State total output of lead in 1945.

About 85 percent of the total lead output was recovered from zinc-lead ores concentrated, and most of the remainder from lead, siliceous, and zinc-lead ores smelted and zinc slag fumed.

Zinc.—The output of recoverable zinc in Utah in 1945 fell 14 percent below the output in 1944 and was the lowest since 1935. All the principal zinc-producing districts contributed to the decline, except Tooele County, which recorded a substantial increase mainly because of the gain in zinc production at the Tooele slag-fuming plant. The West Mountain (Bingham) district showed a decline of 23 percent, attributed largely to the loss in output at the United States & Lark property. The Park City region had a similar decline—22 percent—resulting mainly from decreases at the Park Utah Consolidated and Silver King Coalition properties. The decrease of over 1,000,000 pounds in zinc production from the Tintic district was due almost entirely to the drop in output from the Chief Consolidated mine, virtually the only producer of zinc in the district. The Tooele slag-fuming plant showed a marked increase in zinc production in 1945 over that in 1944 and ranked second among State zinc sources.

The leading producers of zinc in Utah in 1945 were the United States & Lark group in the West Mountain (Bingham) district, the

Tooele slag-fuming plant in Tooele County, the New Park mine in the Park City region, the Chief Consolidated mine in the Tintic district, the Park Utah Consolidated property in the Park City region, the Calumet mine in the Rush Valley district, and the Silver King Coalition mine in the Park City region. These seven properties furnished 93 percent of the State total output of zinc.

Nearly 79 percent of the State total zinc was recovered from zinc-lead ores concentrated, and most of the remainder from lead-smelter slag fumed.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Utah in 1945, by counties, in terms of recovered metals

County	Mines producing [1]	Ore (short tons)	Gold		Silver	
			Fine ounces	Value	Fine ounces	Value
Beaver	12	19,537	454	$15,890	85,770	$60,992
Box Elder	3	806	11	385	225	160
Grand	1	16	----	----	45	32
Iron	1	600	2	70	180	128
Juab	14	91,876	1,510	52,850	421,920	300,032
Salt Lake	10	24,210,713	248,953	8,713,355	3,643,155	2,590,688
San Juan	1	45,380	----	----	585	416
Summit	9	104,274	1,366	47,810	708,795	504,032
Tooele	21	127,361	2,159	75,565	249,435	177,376
Utah	12	70,256	13,067	457,345	671,130	477,248
Wasatch	3	50,335	12,456	435,960	325,035	231,136
Washington	1	2,025	1	35	225	160
Wayne	1	5	----	----	45	32
	89	24,723,184	279,979	9,799,265	6,106,545	4,342,432
Total, 1944	97	30,940,205	344,223	12,047,805	7,593,075	5,399,520

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Beaver	438,400	$59,184	1,396,500	$120,099	899,400	$103,431	$359,596
Box Elder	28,000	3,780	89,500	7,697	155,000	17,825	29,847
Grand	800	108	----	----	----	----	140
Iron	2,000	270	31,500	2,709	158,600	18,239	21,416
Juab	203,600	27,486	4,125,000	354,750	5,698,400	655,316	1,390,434
Salt Lake	448,639,000	60,566,265	45,529,000	3,915,494	29,340,800	3,374,192	79,159,994
San Juan	1,034,000	139,590	----	----	----	----	140,006
Summit	262,800	35,478	11,339,500	975,197	7,239,000	832,485	2,395,002
Tooele	149,800	20,223	6,797,000	584,542	15,935,400	1,832,571	2,690,277
Utah	724,000	97,740	5,834,000	501,724	202,400	23,276	1,557,333
Wasatch	478,000	64,530	6,492,000	558,312	7,631,000	877,565	2,167,503
Washington	791,400	106,839	----	----	----	----	107,034
Wayne	200	27	----	----	----	----	59
	452,752,000	61,121,520	81,634,000	7,020,524	67,260,000	7,734,900	90,018,641
Total, 1944	565,150,000	76,295,250	105,038,000	8,403,040	77,988,000	8,890,632	111,036,247

[1] All lode mines; no placers operated in 1945 or 1944.

MINING INDUSTRY

Shortage of labor was the chief factor in driving down ore production in Utah in 1945; work stoppages were of no great moment, and on the whole the price structure was favorable, compared with 1944. Fewer mines operated in 1945 than in 1944, and the list of active mines included almost no new important operations.

Ore production in 1945 was 20 percent less than in 1944, and most of the loss for the State was in copper ore and zinc-lead ore from the West Mountain (Bingham) district. Nearly 97 percent of the total ore and tailings treated was copper ore, about 2 percent was zinc-lead ore and tailings, and the remainder was principally siliceous ore, zinc ore and slag, and lead ore. During the year, the 12 leading properties—Utah Copper Co., United States & Lark, Columbia, National Tunnel & Mines Co., Tooele slag-fuming plant, Chief Consolidated, New Park Mining Co., Big Indian, Tintic Standard, Calumet, Silver King Coalition, and Park Utah Consolidated—produced 24,544,085 tons of ore, or 99 percent of the State total.

The quantity of siliceous ore mined in the State continued to decline in 1945; the decrease was especially noted in the Tintic district.

The grade of copper ore showed little change from the 1944 content of recoverable metals, but zinc-lead ores increased slightly in content of recoverable lead and zinc, and gold ores improved markedly in gold content.

The severe labor shortage had its effect in curtailing development in 1945, and most of the underground work other than that in the stopes was directed toward preparation for stoping. The most significant project was the continued construction of the 4,600-foot transportation tunnel to the floor of the Utah Copper open pit to provide an outlet for sublevel copper ore. At the close of the year the tunnel was nearing completion.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Utah in 1945, with content in terms of recovered metals

Source	Mines producing [1]	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	10	19,869	10,147	19,140	328,684	34,669	972
Dry and siliceous gold-silver ore	14	56,001	6,649	238,506	659,988	1,048,172	----------
Dry and siliceous silver ore	23	71,821	2,633	670,881	355,308	2,965,000	----------
	47	147,691	19,429	928,527	1,343,980	4,047,841	972
Copper ore	15	23,978,159	229,526	2,087,402	[2]448,735,815	36,917	----------
Lead ore	33	24,305	1,281	280,256	140,402	6,038,051	164,822
Zinc ore	6	[3]104,499	28	7,208	8,370	1,054,562	12,524,369
Zinc-lead ore	28	468,530	29,715	2,803,152	2,523,433	70,456,629	54,569,837
	[4] 89	24,723,184	279,979	6,106,545	[2]452,752,000	81,634,000	67,260,000
Total, 1944	97	30,940,205	344,223	7,593,075	[5]565,150,000	105,038,000	77,988,000

[1] All lode mines; no placers operated in 1945 or 1944.
[2] Includes 22,787,627 pounds recovered from mine-water precipitates.
[3] Includes 79,413 tons of zinc slag.
[4] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.
[5] Includes 35,936,977 pounds recovered from mine-water precipitates.

METALLURGIC INDUSTRY

The 24,723,184 tons of ore produced in Utah in 1945 were treated as follows: 24,456,945 tons (99 percent) at concentrating mills, compared with 30,632,016 tons in 1944; 186,826 tons (nearly 1 percent) shipped crude to smelters, compared with 259,309 tons in 1944; and 79,413 tons (0.3 percent) of old slag fumed, compared with 48,880 tons in 1944.

The nine concentrating mills active in Utah in 1945 treated ore as follows: 5 plants (Arthur, Magna, Ohio Copper, Tooele, and Big Indian), 23,969,590 tons of copper ore and old tailings; 4 mills (Bauer, Midvale, Silver King, and Tooele), 464,355 tons of zinc-lead and lead ores; and 1 flotation mill in Summit County, 23,000 tons of current zinc tailings. The three custom concentration mills in the Valley area have a capacity of 3,900 tons per day, but only about half the capacity was used in 1945. The Midvale 1,700-ton concentrator, operated by the United States Smelting, Refining & Mining Co., was the largest custom mill in the area and treated principally zinc-lead ore, most of which was obtained from company-owned properties in the West Mountain (Bingham) district. The Tooele 1,500-ton concentrator, owned and operated by the International Smelting & Refining Co., was active intermittently in 1945 whenever enough milling ore was available for a run. The concentrator comprises three sections—copper, oxide lead, and sulfide zinc-lead—each of 500 tons daily capacity. At times the sulfide zinc-lead or oxide-lead section was used to treat zinc-copper ore. As in 1944, the bulk of the ore was custom ore. The zinc-copper ore came from California, the oxide ore from the Tintic Standard mine, the copper ore from the National Tunnel & Mines Co., and the zinc-lead ore principally from the Park Utah Consolidated Mines Co., all three in Utah. The 700-ton concentrator of the Combined Metals Reduction Co. at Bauer operated continuously in 1945; the material treated was virtually all zinc-lead ore, and nearly all of it came from company-owned or operated mines in Utah and Idaho. The Silver King Coalition 800-ton concentrator at Park City was active throughout the year and treated only zinc-lead-silver ore from the company mine.

Of the two copper smelters in Utah—the Garfield, operated by the American Smelting & Refining Co., and the Tooele plant of the International Smelting & Refining Co.—only the Garfield plant was active throughout the year. Nearly all the output of the Utah Copper Co. was treated at this plant, and this constituted by far the greatest portion of plant feed. The Tooele copper smelter closed July 1 owing to insufficient ore and concentrates. During its period of operation it treated principally copper concentrates produced from copper ore of the National Tunnel & Mines Co. at Bingham and copper concentrates from milling plants in Nevada.

The Salt Lake area has three lead smelters—Tooele, operated by the International Smelting & Refining Co.; Midvale, operated by the United States Smelting, Refining & Mining Co.; and the Murray plant of the American Smelting & Refining Co. Only the Tooele and Midvale plants were active throughout 1945.

The Tooele lead plant was operated in conjunction with the Tooele slag-fuming plant and treated zinc-lead ore, zinc-copper ore, lead concentrates, and zinc ore from company-owned operations as well as from custom sources. The slag-fuming plant treated 175,562 tons of slag and crude ore in 1945, compared with 133,378 tons in 1944. The resulting zinc fume (18,193 tons) averaged 72.84 percent zinc, and the lead fume (2,034 tons) averaged 46.93 percent lead. The zinc fume was shipped to the National Zinc Co., Inc., Bartlesville, Okla.; the lead fume was re-treated at the Tooele lead smelter. The Midvale plant treated lead concentrates, lead ore, and siliceous ore, mostly from company-owned properties in Utah. The Murray plant closed May 5 for lack of a sufficient supply of lead concentrates and crude lead ore, but reopened in December.

Mine production of metals in Utah in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Concentrates smelted	870,935	259,077	4,850,504	427,233,200	69,697,635	53,574,745
Ore smelted [1]	266,239	20,902	1,256,041	2,731,173	11,936,365	13,685,255
Mine-water precipitates smelted [2]	13,772			22,787,627		
		279,979	6,106,545	452,752,000	81,634,000	67,260,000
Total, 1944		344,223	7,593,075	565,150,000	105,038,000	77,988,000

[1] Includes 79,413 tons of old slag.
[2] All from Salt Lake County.

Gross metal content of concentrates produced from ores mined in Utah in 1945, by classes of concentrates smelted

Class of concentrates	Concentrates (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	690,592	229,579	2,066,602	433,789,573	526,208	
Lead	56,444	13,727	2,088,917	1,807,660	62,052,522	6,215,486
Zinc	50,732	4,949	385,307	780,072	5,774,326	52,990,200
Zinc-lead	1,146	30	11,575	84,113	407,453	1,194,004
Dry iron (from zinc-lead ore)	72,021	10,963	299,956	447,070	4,823,674	5,523,073
	870,935	259,248	4,852,357	436,908,488	73,584,183	65,922,763
Total, 1944	1,076,694	322,551	6,439,644	538,522,192	100,364,676	89,012,910

Mine production of metals from concentrating mills in Utah in 1945, in terms of recovered metals

BY COUNTIES

	Ore milled (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaver	2,169	1,387	24	17,511	7,984	349,188	526,034
Juab	72,955	20,262	745	248,366	97,065	3,492,130	5,694,600
Salt Lake	24,172,591	792,777	243,883	3,526,416	425,308,486	43,777,365	29,299,917
San Juan	45,166	1,925		585	1,017,500		
Summit	78,207	15,662	803	515,594	202,334	10,025,652	6,850,827
Tooele	33,394	15,051	1,136	203,160	123,029	5,179,846	3,513,167
Utah	2,284	1,293	36	16,277	3,606	384,841	59,200
Wasatch	50,179	22,578	12,450	322,595	473,196	6,488,613	7,631,000
	24,456,945	870,935	259,077	4,850,504	427,233,200	69,697,635	53,574,745
Total, 1944	30,632,016	1,076,694	322,551	6,439,644	526,735,253	95,127,271	68,818,141

BY CLASSES OF CONCENTRATES SMELTED

	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Copper	690,592	229,410	2,065,232	424,736,363		
Lead	56,444	13,727	2,088,917	1,329,972	59,934,433	983,428
Zinc	50,732	4,947	384,824	740,696	5,305,916	51,481,895
Zinc-lead	1,146	30	11,575	79,907	372,835	1,109,422
Dry iron (from zinc-lead ore)	72,021	10,963	299,956	346,262	4,084,451	
	870,935	259,077	4,850,504	427,233,200	69,697,635	53,574,745

Gross metal content of Utah crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	19,869	10,147	19,140	336,614	57,177	1,343
Dry and siliceous gold-silver	56,001	6,649	238,506	673,750	1,745,998	
Dry and siliceous silver	71,821	2,633	670,881	365,792	4,936,265	579,710
Copper	8,569	116	22,170	1,236,849	61,680	
Lead	23,034	1,259	268,684	179,625	5,959,805	295,971
Zinc [1]	81,499	285	40,431	758,702	2,375,612	15,605,246
Zinc-lead	5,446	74	30,919	33,956	1,053,200	1,495,202
	266,239	21,163	1,290,731	3,585,288	16,189,737	17,977,472
Total, 1944	259,309	21,651	1,147,960	2,575,469	12,466,443	1,122,375

[1] Includes 79,413 tons of old slag.

Mine production of metals from Utah crude ore shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Beaver	17,368	430	68,259	430,416	1,047,312	373,366
Box Elder	806	11	225	28,000	89,500	155,000
Grand	16		45	800		
Iron	600	2	180	2,000	31,500	158,600
Juab	18,921	765	173,554	106,535	632,870	3,800
Salt Lake	38,122	5,070	116,739	542,887	1,751,635	40,883
San Juan	214			16,500		
Summit	26,067	563	193,201	60,466	1,313,848	388,173
Tooele	93,967	1,023	46,275	26,771	1,617,154	12,422,233
Utah	67,972	13,031	654,853	720,394	5,449,159	143,200
Wasatch	156	6	2,440	4,804	3,387	
Washington	2,025	1	225	791,400		
Wayne	5		45	200		
	266,239	20,902	1,256,041	2,731,173	11,936,365	13,685,255
Total, 1944	259,309	21,651	1,147,903	2,474,570	9,126,229	813,859

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	19,869	10,147	19,140	328,684	34,669	972
Dry and siliceous gold-silver	56,001	6,649	238,506	659,988	1,048,172	
Dry and siliceous silver	71,821	2,633	670,881	355,308	2,965,000	
Copper	8,569	116	22,170	1,211,825	36,917	
Lead	23,034	1,259	268,684	138,915	5,772,749	164,822
Zinc	81,499	24	5,741	7,521	1,043,616	12,437,927
Zinc-lead	5,446	74	30,919	28,932	1,035,242	1,081,534
	266,239	20,902	1,256,041	2,731,173	11,936,365	13,685,255

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Utah in 1945, by counties and districts, in terms of recovered metals

County and district	Mines (all lode) producing [1]	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Beaver County:								
Beaver Lake	1	136	2	114	16, 600			$2, 392
Granite	1	7	1	59		2, 000		249
Newton	1	1	1					35
Pine Grove	1	1, 509	11	623	800	19, 000	271, 000	33, 735
Rocky	1	5, 175	85	9, 419	264, 000			45, 313
San Francisco	3	8, 302	271	42, 570	131, 000	505, 000	46, 800	106, 254
Star and North Star	4	4, 407	83	32, 985	26, 000	870, 500	581, 600	171, 618
Box Elder County:								
Crater Island	1	60	9	69	2, 600			715
Lucin	1	146	1	45	24, 800	1, 000		3, 501
Promontory	1	600	1	111	600	88, 500	155, 000	25, 631
Grand County: La Sal [2]	1	16		45	800			140
Iron County: Indian Peak	1	600	2	180	2, 000	31, 500	158, 600	21, 416
Juab County:								
Detroit	1	59	4	59	1, 200			344
Fish Springs	1	38	1	2, 814		18, 000		3, 584
Tintic [3]	8	90, 893	1, 477	418, 275	195, 000	4, 070, 000	5, 694, 600	1, 380, 359
West Tintic	4	886	28	772	7, 400	37, 000	3, 800	6, 147
Salt Lake County:								
Little Cottonwood	2	856	29	14, 760	69, 400	77, 000		27, 502
Smelter	(4)	292	1	166	800	6, 000		777
West Mountain (Bingham)	8	24, 209, 565	248, 923	3, 628, 229	448, 568, 800	45, 446, 000	29, 340, 800	79, 131, 715
San Juan County: La Sal [2]	1	45, 380		585	1, 034, 000			140, 006
Summit County: Uintah	9	104, 274	1, 366	708, 795	262, 800	11, 339, 500	7, 239, 000	2, 395, 002
Tooele County:								
Camp Floyd	1	10, 914	604	24, 840				38, 804
Dugway	2	1, 986	11	1, 575	4, 600	150, 000	362, 200	56, 679
Erickson	2	52		90		12, 500	8, 600	2, 128
Free Coinage	1	33		90		10, 000	600	993
Lakeside	2	160		135	200	26, 000	7, 000	3, 164
North Tintic	1	45		45		1, 500	9, 200	1, 219
Ophir	4	1, 703	16	12, 870	27, 000	230, 500	108, 600	45, 669
Rush Valley [5]	5	112, 139	1, 171	207, 450	113, 800	6, 274, 500	15, 439, 200	2, 518, 983
Silver Islet	1	40		765	1, 600	7, 000		1, 362
Willow Springs	2	289	357	1, 575	2, 600	85, 000		21, 276
Utah County:								
American Fork	2	333	8	2, 970	1, 000	45, 000	41, 600	11, 181
Tintic [3]	10	69, 923	13, 059	668, 160	723, 000	5, 789, 000	160, 800	1, 546, 152

See footnotes at end of table.

Mine production of gold, copper, lead, and zinc in Utah in 1945, by counties and districts, in terms of recovered metals—Continued

County and district	Mines (all lode) producing [1]	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
Wasatch County:								
Blue Ledge	1	50, 043	12, 451	321, 435	476, 800	6, 451, 000	7, 573, 800	$2, 154, 502
Snake Creek	2	292	5	3, 600	1, 200	41, 000	57, 200	13, 001
Washington County: Tutsagubet	1	2, 025	1	225	791, 400			107, 034
Wayne County: Hanksville	1	5		45	200			59
Total, Utah	89	24, 723, 184	279, 979	6, 106, 545	452, 752, 000	81, 634, 000	67, 260, 000	90, 018, 641

[1] No placers operated in 1945.
[2] La Sal district lies in both Grand and San Juan Counties.
[3] Tintic district lies in both Juab and Utah Counties.
[4] Property not counted as a "mine"; material credited to district came from a slag dump.
[5] Includes production from Smelter district; Bureau of Mines not at liberty to publish separate figures.

BEAVER COUNTY

Beaver Lake district.—The only output from the Beaver Lake district in 1945 was copper ore produced from the O. K. mine by Jesse R. Villars, lessee, and shipped to the Garfield smelter.

Granite district.—A small quantity of lead ore was produced in 1945 from one mine in the Granite district.

Pine Grove district.—The Wah Wah Mining Co., the only operator in the Pine Grove district in 1945, shipped 46 tons of lead ore to the Murray smelter, 1,392 tons of zinc ore to the Tooele lead smelter, and 71 tons of zinc-lead ore to the Bauer mill for concentration.

Rocky district.—The Prosper Mining Co. operated its Old Hickory group and shipped to the Garfield smelter 5,175 tons of copper ore, which contained 85 ounces of gold, 9,419 ounces of silver, and 269,462 pounds of copper.

San Francisco district.—The Horn Silver mine was worked throughout 1945; silver ore was shipped to the Garfield smelter, lead ore to the Murray and Midvale smelters, zinc-lead ore to the Tooele lead smelter, and zinc-lead ore to the Bauer mill. Other production from the district included copper ore shipped direct to smelters from the Imperial group and Cactus mine.

Star and North Star district.—The Moscow Silver Mines Co. worked its group of claims in 1945 and shipped mostly zinc-lead ore to the Bauer mill; one car of lead ore went to the Midvale smelter. Lessees of the Golden Reef group shipped to smelters 392 tons of lead ore containing 47 ounces of gold, 89 ounces of silver, 354 pounds of copper, and 68,485 pounds of lead. James D. Williams, lessee, worked the Harrington-Hickory group throughout 1945; the output comprised 1,641 tons of lead ore, 362 tons of zinc-lead ore, and 86 tons of silver ore, all sent to smelters, and 981 tons of zinc-lead ore treated at the Midvale concentrator. Remaining production from the district was a shipment of lead ore from the St. Mary claim to the Midvale smelter.

BOX ELDER COUNTY

Crater Island district.—Some gold ore was consigned to the Tooele copper smelter from the Copper Blossom mine.

Lucin district.—From the Copper Mountain property, C. E. Massae, lessee, shipped 143 tons of copper ore and 3 tons of lead ore to the Garfield and Tooele smelters.

Promontory district.—The Lakeview Mining Co. shipped zinc-lead ore from the Lake View Carbonate mine to the Tooele lead smelter.

GRAND COUNTY

La Sal district.—Small lots of silver ore and copper ore shipped to the Garfield smelter from the Beaver mine comprised the total metal production of Grand County in 1945.

IRON COUNTY

Indian Peak district.—The only output from Iron County in 1945 was 600 tons of zinc ore from the New Arrowhead mine sent to the Tooele lead smelter.

JUAB COUNTY

Detroit district.—The Ibex Gold Mining Co. shipped a car of gold ore in 1945 to the Garfield smelter.

Fish Springs district.—Lessees shipped lead ore to the Murray smelter from the Utah Mines group.

Tintic district.—The Tintic district, which lies in both Juab and Utah Counties, is reviewed here. The table that follows gives the metal production in each section of the district in 1945, a comparison with the total in 1944, and the grand total from 1869 to 1945.

Mine production of gold, silver, copper, lead, and zinc in Tintic district, Juab and Utah Counties, Utah, 1944–45, and total, 1869–1945, in terms of recovered metals

	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1945								
Juab County	8	90,893	1,477	418,275	195,000	4,070,000	5,694,600	$1,380,359
Utah County	10	69,923	13,059	668,160	723,000	5,789,000	160,800	1,546,152
	18	160,816	14,536	1,086,435	918,000	9,859,000	5,855,400	2,926,511
Total, 1944	22	214,467	11,417	1,070,214	1,066,200	10,637,700	6,899,000	2,942,075
Total, 1869–1945		(1)	2,570,574	259,196,005	242,295,064	1,855,383,079	61,575,538	390,501,118

1 Figures not available.

The Chief Consolidated Mining Co. operated its Chief No. 1, Gemini, and Eureka Hill mines throughout 1945; the Plutus mine was idle. Output from the three mines totaled 75,109 tons, comprising 72,644 tons of zinc-lead ore, 2,189 tons of siliceous silver ore, and 276 tons of lead ore. The total ore contained 789 ounces of gold, 260,585 ounces of silver, 111,387 pounds of copper, 3,824,502 pounds of lead, and 6,277,458 pounds of zinc. The zinc-lead ore went to the Bauer mill for treatment, the silver ore to the Garfield smelter, and the lead ore to the Murray smelter. According to the company printed annual report for the year ended December 31, 1945, 72,644 tons of ore were extracted from the Chief No. 1, 334 tons from the Gemini, and 2,131 tons from the Eureka Hill.

Development at the properties during the year consisted of 3,619 feet of drifts. The company printed annual report states further that the Chief No. 1 shaft was repaired, that part of the Gemini shaft was retimbered, and that a permanent pumping system was being established in the Chief No. 1, which would permit the lower workings to be always accessible down to the 2,500 level. Repair of the Chief No. 1 shaft necessitated a five-day work week in the stopes instead of the usual six-day work week, which was the main factor in reducing output of ore from the mine.

Lessees operated the Centennial-Beck-Victoria mine of the United States Smelting, Refining & Mining Co. from April through December and shipped several cars of siliceous silver ore to the Garfield smelter and a quantity of lead ore to the Midvale smelter. The Mammoth Mining Co. operated at a reduced rate in 1945 and sent about 6,000 tons of siliceous gold-silver ore to the Garfield smelter. Philip Clark, lessee, worked the Godiva mine of the Godiva Mining & Milling

Co. throughout the year and shipped several cars of siliceous silver ore to the Garfield smelter. The Alaska mine produced zinc-lead ore, which was treated at the Midvale concentrator. Other production from the district, all shipped direct to smelters, was as follows: Dragon and Martha Washington properties, siliceous gold-silver ore; Showers group, siliceous silver ore; Lockheed group, siliceous gold ore; Bonanza group, lead ore; Old Scotia mine, lead ore; and Treboar & Huber property, lead ore.

The Tintic Standard Mining Co. and its subsidiary companies continued in 1945 to produce the major part of the recoverable metal from the Utah County section of the Tintic district. In spite of a continued shortage of manpower, ore produced from the Tintic Standard and the Iron Blossom mines totaled 40,880 tons (Tintic Standard. 38,064 tons; Iron Blossom, 2,816 tons), a gain of 12,735 tons over the output in 1944.

The Tintic Standard mine produced 38,064 tons of ore with metal content as follows: 25,402 tons of siliceous silver ore shipped to the Garfield and Tooele copper smelters contained 1,537 ounces of gold, 309,330 ounces of silver, 188,427 pounds of copper, and 2,622,809 pounds of lead; 11,391 tons of lead ore consigned to lead smelters at Tooele, Murray, and Midvale contained 412 ounces of gold, 146,958 ounces of silver, 59,719 pounds of copper, 3,285,091 pounds of lead, and 198,000 pounds of zinc; and 1,271 tons of lead ore treated at the Tooele concentrator yielded 689 tons of lead concentrate containing 22 ounces of gold, 11,572 ounces of silver, 1,749 pounds of copper, 270,027 pounds of lead, and 18,885 pounds of zinc. Output from the Iron Blossom mine was 2,816 tons of siliceous silver ore sent to the Garfield smelter; the metal content was 108 ounces of gold, 15,981 ounces of silver, 3,574 pounds of copper, and 278,303 pounds of lead. Development at the Tintic Standard and Iron Blossom mines consisted of 2,969 feet of drifts at the Tintic Standard and 145 feet of drifts at the Iron Blossom. In 1945 the Harold dump was worked only during April and supplied 1,633 tons of gold-silver ore to the Garfield smelter, compared with 56,587 in 1944.

The Eureka Lilly Consolidated Mining Co. and the Colorado Consolidated Mines Co. operated their properties throughout 1945. Gold-silver ore was produced from each and shipped to the Garfield smelter—9,046 tons from the Eureka Lilly mine contained 1,668 ounces of gold, 80,192 ounces of silver, 389,695 pounds of copper, and 328 pounds of lead, and 4,497 tons from the Colorado mine contained 280 ounces of gold, 21,560 ounces of silver, 6,176 pounds of copper, and 344,758 pounds of lead.

Throughout 1945 the North Lily Mining Co. worked the Tintic Bullion, North Lily, and Eureka Bullion mines. The Tintic Bullion produced mainly gold ore, which was shipped direct to smelters, but some zinc-lead ore was treated at the Tooele concentrator; gold-silver ore was produced from the North Lily and sent to smelters; and the output from the Eureka Bullion was mostly silver ore, which, along with some gold-silver ore, was shipped direct to smelters. Development at the three mines comprised 371 feet of crosscuts, 346 feet of drifts, 392 feet of raises, and 2,973 feet of diamond drilling. Other production in the district included gold-silver ore shipped to smelters from the Mountain View group and the Yankee mine.

SALT LAKE COUNTY

Little Cottonwood district.—Test lots of ore were taken in 1945 from various places in the South Hecla mine of the Alta United Mines Co.; five cars of silver ore and two of copper ore were shipped to the Garfield smelter, and one car of lead ore to the Murray smelter. The Wasatch Mines Co. operated its Columbus-Flagstaff group and shipped copper ore and a little silver ore to the Garfield smelter and a car of lead ore to the Murray smelter. The total of 510 tons contained 17 ounces of gold, 10,168 ounces of silver, 61,385 pounds of copper, 84,788 pounds of lead, and 12,917 pounds of zinc.

Smelter district.—Output credited to the Smelter district in 1945 was lead plant dump slag shipped to a smelter.

West Mountain (Bingham) district.—In 1945 the West Mountain (Bingham) district produced 89 percent of the State gold output, 59 percent of the silver, 99 percent of the copper, 56 percent of the lead, and 44 percent of the zinc; the total value of the metal output declined 20 percent from that in 1944. The following table shows production from mines in the Bingham district in 1944 and 1945 and the total from 1865 to 1945.

Mine production of gold, silver, copper, lead, and zinc in Bingham or West Mountain district, Salt Lake County, Utah, 1944–45, and total, 1865–1945, in terms of recovered metals

Year	Mines producing	Ore (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1944	11	30,344,838	312,493	4,671,478	562,199,000	62,337,300	38,302,000	$99,509,472
1945	8	24,209,565	248,923	3,628,229	448,568,800	45,446,000	29,340,800	79,131,715
Total, 1865–1945	--------	(1)	5,703,152	141,094,341	[2] 4,558,238	[2] 1,549,686	[2] 472,104	1,754,997,392

[1] Figures not available.
[2] Short tons.

At the Utah Copper Co. mine in Bingham Canyon operations in the open pit were continuous throughout the year except for brief stoppages resulting from labor strikes. The chief factor in preventing the company from maintaining its high production level of the war years was the continued acute labor shortage. Nevertheless, the company remained the Nation's leading copper and gold producer, and it also ranked high in the production of silver and molybdenum. Copper ore was milled at the Arthur and Magna plants at the rate of 67.517 tons a day, compared with 80,868 tons in 1944. The ore treated averaged slightly lower in gold content but slightly higher in copper and silver. Late in the year the company announced a new schedule for the two mills—12 days in operation and 2 days closed because of the inability of the Garfield smelter to handle concentrates from the two mills when both were operating at full time.

In addition to the large quantity of copper produced from copper concentrates from the Magna and Arthur mills, the company continued to produce important quantities of copper from the leaching of waste dumps. The precipitating plant is at Lead Mine in the mouth of Bingham Canyon.

After the war the company announced that it would shortly launch a $3,500,000 program to rehabilitate the mine and the mills after a long war period of crowding all production facilities beyond the normal limit. It is planned to develop the mine extensively and to replace much worn mine and mill equipment.

The Boston Consolidated mine, owned by the Utah Copper Co., was worked under lease from January to September by the American Smelting & Refining Co.; gold-copper ore was shipped to the Garfield smelter.

The United States & Lark property, operated by the United States Smelting, Refining & Mining Co., continued to be the leading producer of lead and zinc in the State and was second in the production of gold and silver. The mine produced nearly 115,000 tons less ore in 1945 than in 1944, which caused a marked decline in output of lead and zinc in the West Mountain (Bingham) district. The great bulk of the output was zinc-lead ore treated at the Midvale concentrator, but in addition some gold-silver ore was shipped to the Garfield smelter, lead ore to the Midvale smelter, and a small quantity of zinc-lead ore to the Tooele slag-fuming plant. The ore produced declined slightly in gold and copper content but increased in silver, lead, and zinc. Development at the property was less than in 1944 and comprised 11,589 feet of drifts, 2,960 feet of raises, and 3,108 feet of diamond drillings. The Niagara mine and the Montana-Bingham Consolidated Mining Co. group also were operated by the United States Smelting, Refining & Mining Co. Ore from the two mines in 1945 was about 1,300 tons less than in 1944 and was nearly all zinc-lead ore treated at the Midvale concentrator; a small quantity of gold ore from the Niagara mine was shipped to the Garfield smelter. Development at the two properties included 991 feet of drifts and 1,625 feet of diamond drilling.

The National Tunnel & Mines Co. worked the Apex-Delaware group throughout the year, but output of ore was nearly 35 percent less than in 1944. The output was largely copper ore treated at the Tooele concentrator, but a substantial tonnage of zinc-lead ore also went to the Tooele concentrator, and smaller quantities of gold-silver ore were shipped to the Garfield and Tooele copper smelters and zinc-lead ore to the Tooele lead smelter. Development at the mine was less than in 1944 and comprised 1,460 feet of crosscuts and raises, 1,579 feet of drifts, 93 feet of winze, and 5,368 feet of diamond drilling.

The Ohio Copper Co. operated continuously its 1,500-ton leaching-flotation plant near Lark, but the precipitation plant for treating solutions pumped through old stopes was closed in July. During the year, 465,620 tons of old tailings were treated containing an average of 7.8 pounds of copper to the ton, compared with 493,413 tons treated in 1944 containing an average of 7.7 pounds of copper to the ton. Production of copper concentrate in 1945 was 5,303 tons containing 371 ounces of gold, 3,939 ounces of silver, and 2,287,521 pounds of copper. In addition, 175,910 pounds of copper were produced at the leaching-precipitation plant. According to the company printed annual report for the year ended December 31, 1945, 1,855,000 tons of old tailings are still available for treatment. Plans have been completed and equipment ordered to set up a cheaper method of moving the tailings to the concentrator to make profitable the treatment of the remaining tailings pile despite its lower copper content.

Combined Metals Reduction Co. and lessees operated the Butterfield group in 1945 and produced 19,584 tons of zinc-lead ore, compared with a total of 26,221 tons in 1944. The Bauer mill treated 18,458 tons of the 1945 output, and the remainder went to the Tooele concentrator.

SAN JUAN COUNTY

La Sal district.—The Ohio Copper Co. expanded operations at its Big Indian open-pit mine in 1945 and increased production to 45,380 tons, compared with 8,009 tons in 1944. The company's 250-ton flotation mill treated 45,166 tons of carbonate copper ore, which yielded 1,925 tons of copper concentrate containing 585 ounces of silver and 1,038,331 pounds of copper. In addition, 214 tons of copper ore containing 16,837 pounds of copper were shipped to the Garfield smelter.

SUMMIT AND WASATCH COUNTIES

PARK CITY REGION

Included with the Park City region are the Uintah district in Summit County and the Blue Ledge and Snake Creek districts in Wasatch County. Although output of the five metals continued to decline in 1945, the region remained a large producer of lead and zinc and furnished appreciable quantities of gold and silver. The following table shows the production and total value of the five metals in 1945 compared with 1944 and the total from 1870 to 1945.

Mine production of gold, silver, copper, lead, and zinc in Park City region, Summit and Wasatch Counties, Utah, 1944–45, and total, 1870–1945, in terms of recovered metals

Year	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
1944	8	203, 001	15, 149	1, 429, 650	956, 800	23, 319, 600	19, 111, 000	$5, 720, 245
1945	12	154, 609	13, 822	1, 033, 830	740, 800	17, 831, 500	14, 870, 000	4, 562, 505
Total, 1870–1945		(1)	544, 850	233, 765, 278	67, 744, 913	2, 391, 698, 934	668, 058, 611	361, 639, 653

1 Figures not available.

The Silver King Coalition Mines Co. operated its mine throughout the year and produced a total of 31,117 tons of ore, a decline of 43 percent from the output in 1944. Of this quantity, 28,524 tons of zinc-lead ore were treated in the company's 800-ton flotation mill at an average daily rate of 127 tons. The mill feed produced 3,299 tons of lead concentrate containing 244 ounces of gold, 218,551 ounces of silver, 94,109 pounds of copper, and 4,596,666 pounds of lead and 2,059 tons of zinc concentrate containing 20 ounces of gold, 7,079 ounces of silver, 7,677 pounds of copper, 59,491 pounds of lead, and 2,548,420 pounds of zinc. In addition, direct shipments to smelters comprised 1,606 tons of siliceous silver ore containing 25 ounces of gold, 13,884 ounces of silver, 5,341 pounds of copper, and 106,862 pounds of lead and 987 tons of lead ore containing 58 ounces of gold, 56,269 ounces of silver, 19,354 pounds of copper, and 433,792 pounds of lead.

According to its printed annual report for the year ended December 31, 1945, the company operated under the following assigned quotas from the Quota Committee of the Premium Price Plan during 1945:

Copper, zero A quota, 5-cent premium over the ceiling price.
Lead, zero A quota, 2¾-cent premium, and zero B quota, an additional 2¾ cents.
Zinc, zero A quota, 2¾-cent premium; zero B quota, an additional 2¾ cents; and zero C quota, another 2¾ cents, or a total of 8¼ cents over the ceiling price.

Development at the property comprised 917 feet of raises, 10,096 feet of drifts, 9 feet of winze, and 430 feet of diamond drilling. In addition, the company's printed report states that unwatering of the West End section of the mine was completed, and mining operations were resumed on the 1,800, 1,900, and 1,960 levels. Preparations for sinking below the 1,960 level have been nearly completed.

The Park Utah Consolidated Mines Co. worked its Park Utah Consolidated group in Summit and Wasatch Counties throughout 1945, but at a reduced rate, owing to labor shortage. Output was 27,893 tons of zinc-lead ore, a decrease of 28 percent from that in 1944. Of the ore produced, 26,388 tons were treated at the Tooele concentrator; gross metal content was 656 ounces of gold, 296,970 ounces of silver, 141,539 pounds of copper, 6,031,056 pounds of lead, and 5,064,809 pounds of zinc. The remaining 1,505 tons were shipped to the Tooele lead smelter; metal content was 27 ounces of gold, 18,218 ounces of silver, 15,884 pounds of copper, 455,260 pounds of lead, and 525,280 pounds of zinc. Development during the year was much less than in 1944 and comprised 9,483 feet of drifts and 3,502 feet of diamond drilling. Employment at the mine dropped from an average of 290 men in 1944 to 218 in 1945, according to the company's printed annual report for the year ended December 31, 1945.

The New Park Mining Co. operated its Park Galena and Mayflower properties continuously in 1945 and produced 50,043 tons of ore, compared with 57,640 in 1944. Nearly all (49,888 tons) was zinc-lead ore treated at the Midvale concentrator; gross metal content was 13,754 ounces of gold, 352,040 ounces of silver, 719,078 pounds of copper, 7,096,498 pounds of lead, and 10,150,280 pounds of zinc, indicating an increase in gold, copper, lead, and zinc content but a decrease in silver compared with 1944. The remaining output was 155 tons of silver ore shipped to the Midvale smelter; it contained 6 ounces of gold, 2,346 ounces of silver, 7,441 pounds of copper, and 2,825 pounds of lead. Development exceeded that in 1944 and comprised 73 feet of shaft sinking, 3,181 feet of drifts, 850 feet of raises, and 10,986 feet of diamond drilling. In addition, a station and skip pocket were being cut on the 1,380 level.

Reuben Garbett, working on Silver Creek with a small flotation mill, continued to re-treat current tailings from the Silver King Coalition mill. From about 23,000 tons of tailings, 311 tons of zinc middling were produced and sent to the Midvale concentrator for further treatment. The remaining production from the Uintah district was 32,134 tons of old tailings, principally siliceous, shipped to the Garfield smelter. From the New Quincy mine in the Snake Creek district in

Wasatch County the Empire Canyon Mining Co. shipped 291 tons of zinc-lead ore to the Tooele concentrator.

TOOELE COUNTY

Camp Floyd district.—The Geyser Marion group, the only producing property in the Camp Floyd district in 1945, was worked from January to September, and siliceous gold-silver ore was shipped to the Garfield smelter.

Dugway district.—The Rip Van Winkle Consolidated Mining Co. operated the Smelter Canyon and Four Metals group throughout the year. Of the total output, the Tooele lead smelter received 1,471 tons of zinc-lead ore containing 9 ounces of gold, 1,125 ounces of silver, 348 pounds of copper, 110,068 pounds of lead, and 402,845 pounds of zinc. The remaining 484 tons of zinc-lead ore went to the Tooele concentrator and Bauer mill for treatment; the metal content was 3 ounces of gold, 411 ounces of silver, 68 pounds of coper, 43,143 pounds of lead, and 110,042 pounds of zinc. Other production from the district was from the Cannon property and comprised 21 tons of copper ore consigned to the Tooele and Garfield copper smelters and 10 tons of lead ore to the Tooele lead smelter.

Erickson district.—The Ida group and the Tintic Delaware mine together produced 52 tons of zinc-lead ore in 1945; 38 tons went to the Tooele lead smelter and 14 tons to the Tooele concentrator.

Free Coinage district.—Total production from the Free Coinage district in 1945 was 33 tons of lead ore shipped to the Tooele lead smelter; metal content was 90 ounces of silver, 10,160 pounds of lead, and 753 pounds of zinc.

Lakeside district.—Two properties were worked in the Lakeside district in 1945—one produced 49 tons of zinc ore sent to the Tooele lead smelter and the other 111 tons of lead ore shipped to the Murray smelter.

North Tintic district.—H. A. Bellows shipped 45 tons of zinc ore from the Scranton waste dump to the Tooele lead smelter.

Ophir district.—The Ophir Hill mine, operated by the Ophir Development Co. throughout the year, was the largest producer in the Ophir district. Output comprised 490 tons of zinc-lead ore treated at the Tooele concentrator, 265 tons of zinc-lead ore shipped to the Tooele lead smelter, and 61 tons of silver ore shipped to the Garfield smelter. Recovered metals totaled 6 ounces of gold, 5,831 ounces of silver, 12,711 pounds of copper, 146,953 pounds of lead, and 66,488 pounds of zinc. The Ophir unit of the United States Smelting, Refining & Mining Co. operated at about 65 percent of its 1944 rate. The bulk of the output was zinc-lead ore treated at the Midvale and Tooele concentrators. Other production from the district included 54 tons of copper ore consigned to the Garfield smelter from the Shoo Fly group and 30 tons of lead ore shipped to the Midvale smelter from the Mecca group.

Rush Valley district.—The leading producer in the Rush Valley district in 1945 was the West Calumet (Calumet) mine operated by the Combined Metals Reduction Co. The company mined 31,263 tons of zinc-lead ore, which was treated at the Bauer mill, and 414 tons of lead ore shipped to the Tooele lead smelter. The company also operated the Honerine & Galena King group and mined 769 tons of zinc-lead ore—545 tons went to the Bauer mill and 224 tons to the Tooele lead smelter. From the Silver Eagle group the Hampton Mining Co. shipped 36 tons of zinc-lead ore to the Tooele lead smelter and 172 tons of similar ore to the Bauer mill for treatment. Gross metal content of the total ore was 11 ounces of gold, 976 ounces of silver, 18,428 pounds of lead, and 26,162 pounds of zinc. The Blue Eagle Mining Co. produced from its three claims 72 tons of lead ore, which were shipped to the Tooele lead smelter.

Silver Islet district.—Total production of the Silver Islet district in 1945 was 40 tons of lead ore shipped to the Murray smelter from the Morning Star mine.

Smelter district.—The slag-fuming plant of the International Smelting & Refining Co. remained the second largest producer of zinc in Utah in 1945. The plant was operated continuously during the year and fumed a total of 175,562 tons of hot current slag, old cold slag, and crude ore. However, only the metals recovered from the fuming of 79,413 tons of old slag are credited to the plant as a producer in the "Smelter district." The remaining metals are credited to the individual mines producing the ore and concentrates that yielded the current hot slag for treatment in the slag-fuming plant.

Willow Springs district.—Lessees operated the Oro Del Rey group and shipped 173 tons of lead ore to the Murray and Tooele lead smelters and 114 tons of gold ore to the Garfield and Tooele copper smelters. Metal content of the total ore was 336 ounces of gold, 1,571 ounces of silver, 2,614 pounds of copper, and 90,671 pounds of lead. Lee Trout sent a test lot of gold ore from the Depression claim to the Garfield smelter.

UTAH COUNTY

American Fork district.—From its Globe mine, the Howell Mining Co. shipped to the Tooele concentrator 331 tons of zinc-lead ore containing 9 ounces of gold, 2,968 ounces of silver, 1,460 pounds of copper 49,424 pounds of lead, and 65,012 pounds of zinc.

Tintic district.—Mines in the Utah County section of the Tintic district are reviewed under Juab County.

WASHINGTON COUNTY

Tutsagubet district.—The Apex Mining Co. operated the Dixie mine from June to the end of the year and shipped 2,025 tons of copper ore to the Garfield smelter.

WAYNE COUNTY

Hanksville district.—A. Hunt & Sons shipped 5 tons of silver ore from the Copper Queen claim to the Garfield smelter.

GOLD, SILVER, COPPER, LEAD, AND ZINC IN WASHINGTON

(MINE REPORT)

By C. E. Needham and Paul Luff

SUMMARY OUTLINE

SUMMARY

In Washington the production of gold only, of the five metals gold, silver, copper, lead, and zinc, gained in 1945 compared with 1944. Gold output increased 22 percent in both quantity and value, but silver declined over 12 percent in quantity and value, copper nearly 6 percent in quantity and value, lead 35 percent in quantity and 30 percent in value, and zinc nearly 2 percent in quantity and 1 percent in value. The total value of the five metals, in terms of recoverable metals, decreased from $7,195,136 in 1944 to $7,140,242 in 1945; zinc contributed 38 percent of the total value, gold 28, copper 22, lead 9, and silver 3.

Although Pend Oreille County outranked all other counties in total value of the five metals in 1944, it yielded first place to Chelan County in 1945, largely because of an increased gold and zinc output from the Holden mine of the Howe Sound Co. and a marked decrease in lead and zinc production in Pend Oreille County. The two counties remained far in the lead among Washington counties in 1945 and together produced 84 percent of the State total value of the five metals.

Labor shortages continued to hamper both production and development of base-metal deposits throughout the year, but lode-gold output, principally at the Knob Hill mine, was stimulated considerably following the revocation, July 1, 1945, of War Production Board Order L-208. However, the loss in byproduct gold more than balanced the gain in straight gold mining, so that total output for the later months of the year did not equal that of some of the earlier months.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–5: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

Mine production of gold, silver, copper, lead, and zinc in Washington, 1941–45, and total, 1860–1945, in terms of recovered metals

Year	Mines producing		Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer		Fine ounces	Value	Fine ounces	Value
1941	61	56	1,238,509	84,176	$2,946,160	402,030	$285,888
1942	37	18	1,222,937	75,396	2,638,860	369,038	262,427
1943	24	2	1,131,281	65,244	2,283,540	370,440	263,424
1944	25	3	1,180,662	47,277	1,654,695	321,608	228,699
1945	21	3	968,246	57,860	2,025,100	281,444	200,138
1860–1945			(1)	2,127,502	53,217,893	12,565,420	8,895,835

Year	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
1941	17,372,000	$2,049,896	7,806,000	$444,942	28,640,000	$2,148,000	$7,874,886
1942	16,060,000	1,943,260	9,702,000	650,034	28,796,000	2,678,028	8,172,609
1943	14,630,000	1,901,900	10,044,000	753,300	24,406,000	2,635,848	7,838,012
1944	12,338,000	1,665,630	11,650,000	932,000	23,808,000	2,714,112	7,195,136
1945	11,642,000	1,571,670	7,604,000	653,944	23,386,000	2,689,390	7,140,242
1860–1945	[2] 74,399	19,233,761	[2] 72,776	9,495,858	[2] 126,486	19,614,372	110,457,719

[1] 1860–1903: Figures not available; 1904–45: 11,667,399 tons produced.
[2] Short tons.

Mine production of gold, silver, copper, lead, and zinc in Washington in 1945, by months, in terms of recovered metals

	Gold (ounces)	Silver (ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
January	3,993	22,719	1,014,000	790,000	2,122,000
February	3,705	21,798	778,000	880,000	2,166,000
March	5,116	28,921	1,264,000	920,000	2,374,000
April	5,471	28,169	1,116,000	714,000	2,112,000
May	5,478	28,638	1,130,000	674,000	2,210,000
June	5,322	23,668	1,008,000	632,000	1,962,000
July	5,337	23,475	878,000	324,000	1,402,000
August	5,732	26,470	950,000	650,000	1,456,000
September	4,025	19,436	784,000	464,000	1,772,000
October	4,544	19,518	862,000	580,000	1,912,000
November	4,443	18,315	880,000	430,000	2,116,000
December	4,694	20,317	978,000	546,000	1,782,000
Total	57,860	281,444	11,642,000	7,604,000	23,386,000

Gold.—The increase of over 10,000 ounces in the State output of recoverable gold in 1945 over 1944 resulted largely from a greater output of gold from the Holden property of the Howe Sound Co. in Chelan County, which remained the State's leading gold producer. Although the tonnage of zinc-copper ore from this mine dropped 19 percent from 1944, the average gold content of the ore increased enough in 1945 to bring the gross value of the recoverable gold to a total one-half million dollars above that for the preceding year. The only other important gold producer in 1945 was the Knob Hill mine in Ferry County, which failed to equal its 1944 output by about 2,000 ounces. These two mines produced 97 percent of the State total output of gold in 1945. Output of gold from placers in 1945 (14 fine ounces) was less than one-fourth the quantity produced from such deposits in 1944. Nearly 88 percent of the State gold output in 1945 was recovered from ore treated in concentration mills and most of the remainder from current slimes cyanided.

Silver.—No silver ore was produced in Washington in 1945; thus silver production remained entirely a byproduct of gold and base-metal ores, and the output from these sources declined more than 12 percent from that in 1944. As with gold, the two leading silver producers were the Holden and Knob Hill mines, which together furnished nearly 82 percent of the State total. The Kaaba mine in Okanogan County contributed an additional 9 percent, but its output in 1945 was only half of that in 1944.

Zinc-copper ore advanced to first place in 1945 as a source of silver, supplying 43 percent of the State total; gold ore dropped to a close second with 42 percent, followed by zinc-lead ore with 14 percent. Placers yielded no silver in 1945. About 86 percent of the State silver output in 1945 was recovered from ore treated in concentration mills, 10 percent from concentrates and current slimes cyanided, and the remainder from crude ore smelted.

Copper.—For the fifth consecutive year production of copper in Washington declined; output in 1945 was only 61 percent of that in the peak year 1940. As in previous years, the only significant production came from zinc-copper ore treated by flotation from the Holden mine in Chelan County. Smaller quantities of copper were produced at the Kaaba mine in Okanogan County and at the Sunset mine in Snohomish County.

Lead.—The sharp decline in the output of recoverable lead in Washington in 1945 was due mainly to a reduced tonnage of zinc-lead ore from the Metaline district in Pend Oreille County and to a lower lead content of the ore treated. The Grandview mine of the American Zinc, Lead & Smelting Co. was the largest producer, followed by the properties of the Pend Oreille Mines & Metals Co. and the Metaline Mining & Leasing Co., all in Pend Oreille County, and the Deep Creek mine of the Jamison-Higginbotham Mining Co. in Stevens County, in the order named. These four properties produced 95 percent of the State total in 1945. About 96 percent of the total lead output was recovered from zinc-lead ore concentrated and nearly all the remainder from lead ore concentrated.

Zinc.—The output of recoverable zinc held up well in Washington in 1945, and the slight decline resulted chiefly from less zinc-lead ore mined from the property operated by the Pend Oreille Mines & Metals

Co. in the Metaline district. However, this property was exceeded in production in 1945 only by the Grandview mine and was followed in order by the Metaline Mining & Leasing Co., the Holden mine of the Howe Sound Co., which doubled its output, and the Deep Creek mine. These five properties produced 99 percent of the State total zinc in 1945. About 67 percent of the total zinc was recovered from zinc-lead ore concentrated, nearly 21 percent from zinc-copper ore concentrated, and 12 percent from zinc ore concentrated.

MINE PRODUCTION BY COUNTIES

Mine production of gold, silver, copper, lead, and zinc in Washington in 1945, by counties, in terms of recovered metals

County	Mines producing		Gold (lode and placer)		Silver (lode and placer)	
	Lode	Placer	Fine ounces	Value	Fine ounces	Value
Benton		1	11	$385		
Chelan	2		40,450	1,415,750	121,434	$86,353
Ferry	5		17,363	607,705	117,599	83,626
Kittitas		1	2	70		
Okanogan	3		22	770	24,314	17,290
Pend Oreille	3	1	1	35	11,191	7,958
Pierce	1		2	70	21	15
Snohomish	3		4	140	218	155
Stevens	4		5	175	6,667	4,741
	21	3	57,860	2,025,100	281,444	200,138
Total, 1944	25	3	47,277	1,654,695	321,608	228,699

County	Copper		Lead		Zinc		Total value
	Pounds	Value	Pounds	Value	Pounds	Value	
Benton							$385
Chelan	11,605,600	$1,566,756			4,837,600	$556,324	3,625,183
Ferry	2,800	378	3,500	$301	11,000	1,265	693,275
Kittitas							70
Okanogan	21,200	2,862	216,500	18,619	87,200	10,028	49,569
Pend Oreille			7,011,000	602,946	15,588,000	1,792,620	2,403,559
Pierce							85
Snohomish	11,000	1,485					1,780
Stevens	1,400	189	373,000	32,078	2,862,200	329,153	366,336
	11,642,000	1,571,670	7,604,000	653,944	23,386,000	2,689,390	7,140,242
Total, 1944	12,338,000	1,665,630	11,650,000	932,000	23,808,000	2,714,112	7,195,136

Gold and silver produced at lode mines in Washington in 1945, by counties, in terms of recovered metals

County	Ore sold or treated (short tons)	Gold (fine ounces)	Silver (fine ounces)
Chelan	621,496	40,450	121,434
Ferry	48,918	17,363	117,599
Okanogan	12,197	22	24,314
Pend Oreille	253,884		11,191
Pierce	5	2	21
Snohomish	38	4	218
Stevens	31,708	5	6,667
	968,246	57,846	281,444
Total, 1944	1,150,662	47,218	321,601

Gold and silver produced at placer mines in Washington in 1945, by counties, in fine ounces, in terms of recovered metals

County	Sluicing and hydraulic		Dragline and dry-land dredges [1]		Total	
	Gold	Silver	Gold	Silver	Gold	Silver
Benton	11				11	
Kittitas	2				2	
Pend Oreille	1				1	
	14				14	
Total, 1944	4		55	7	59	7

[1] A floating washing plant supplied with gravel by a dragline excavator is called a "dragline dredge"; a stationary or movable washing plant supplied with gravel by any type of power excavator is called a "dry-land dredge."

MINING INDUSTRY

In addition to inadequate manpower to maintain production and development of ore, the industry in 1945 was handicapped in some districts by a shortage of houses, particularly for men from the armed forces returning to the mines. Supplies and equipment remained in short supply in many sections, thus further hindering the industry.

The base prices of copper ($0.12 a pound), lead ($0.065 a pound), and zinc ($0.0825 a pound) remained unchanged in 1945, and the Government policy of premium payments for overquota production continued during the year. Owing to upward revisions in premium payments, the average weighted prices of copper, lead, and zinc advanced slightly over prices prevailing in 1944, the greatest advance being in the price of lead.

Although the general trend of prices for base metals was slightly upward in 1945, the general trend of ore output was downward, resulting in an 18-percent reduction in the quantity produced. During the year, the seven leading properties produced 947,167 tons of ore—98 percent of the State total. Declines were especially sharp in zinc-copper ore mined in the Chelan Lake district and in zinc-lead ore mined in the Metaline district.

The grade of gold ore treated in 1945 showed little change from 1944, but zinc-copper ore improved substantially in content of recoverable gold, silver, copper, and zinc. On the other hand, zinc-lead ores showed a marked drop in content of recoverable silver, copper, and lead but slight change in zinc.

Development on company account in the seven leading properties—Holden, Pend Oreille, Metaline, Grandview, Kaaba, Knob Hill, and Deep Creek mines—was much less than in 1944 and consisted largely of preparation for stoping. Total footage comprised 8,824 feet of drifts and raises and 37,824 feet of diamond drilling. The Bureau of Mines continued its program of diamond drilling, mostly in the Metaline district, but late in the summer was forced to curtail the program severely because of a reduced budget.

ORE CLASSIFICATION

Details of ore classification are given in the chapter of this volume on Gold and Silver.

Ore sold or treated in Washington in 1945, with content in terms of recovered metals

Source	Mines producing	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold ore	8	53,174	17,630	118,568	----------	----------	----------
Copper ore	3	38	4	218	11,000	----------	----------
Lead ore	1	1,800	2	2,644	822	287,056	3,970
Zinc ore	3	29,607	----------	911	2,800	24,700	2,826,800
Zinc-copper ore	1	617,120	40,207	120,482	11,605,600	----------	4,837,600
Zinc-lead ore	6	266,507	3	38,621	21,778	7,292,244	15,717,630
Total, lode mines	[1] 21	968,246	57,846	281,444	11,642,000	7,604,000	23,386,000
Total, placers	3	----------	14	----------	----------	----------	----------
	24	968,246	57,860	281,444	11,642,000	7,604,000	23,386,000
Total, 1944	28	1,180,662	47,277	321,608	12,338,000	11,650,000	23,808,000

[1] A mine producing more than 1 class of ore is counted but once in arriving at total for all classes.

METALLURGIC INDUSTRY

Of the 968,246 tons of lode material from Washington mines sold or treated during 1945, 914,931 tons (94 percent) went to concentrating mills, 34,623 tons (4 percent) to a cyanidation-concentration mill, and 18,692 tons (2 percent) to smelters, compared with 95 percent to concentrating mills, nearly 4 percent to a cyanidation-concentration mill, and less than 2 percent to smelters in 1944.

Cyanidation mills.—In 1945 the cyanide plant of the Holden mill of the Howe Sound Co. operated only in December, during which time 45,265 tons of current flotation tailings from copper ore were cyanided. The 400-ton cyanidation-concentration mill of Knob Hill Mines, Inc., was active throughout the year and cyanided 32,453 tons of current flotation tailings and 774 tons of flotation concentrates from the company mine. The two cyanide plants consumed 81,182 pounds of calcium cyanide, 16,858 pounds of zinc dust, and 473,400 pounds of lime.

The 914,931 tons of ore treated by concentration in 1945 were distributed among eight mills as follows: One plant, 617,120 tons of zinc-copper ore; four plants, 266,034 tons of zinc-lead ore; two plants, 29,562 tons of zinc ore; and one plant, 1,800 tons of lead ore and 370 tons of zinc-lead ore. In addition, 45 tons of zinc ore were shipped to the Combined Metals Reduction Co. plant at Bauer, Utah, for treatment.

Mine production of metals in Washington in 1945, by methods of recovery, in terms of recovered metals

Method of recovery	Material treated (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Concentrates and current slimes cyanided	78,492	5,060	27,907	----------	----------	----------
Concentrates smelted	55,131	50,872	243,123	11,630,956	7,562,479	23,363,320
Ore smelted	18,692	1,914	10,414	11,044	41,521	22,680
Placer	----------	14	----------	----------	----------	----------
	----------	57,860	281,444	11,642,000	7,604,000	23,386,000
Total, 1944	----------	47,277	321,608	12,338,000	11,650,000	23,808,000

Mine production of metals from cyanidation mills[1] *(with or without concentration equipment) in Washington in 1945, by counties, in terms of recovered metals*

County	Ore treated (short tons)	Recovered in bullion		Concentrates smelted and recovered metal		
		Gold (fine ounces)	Silver (fine ounces)	Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)
Chelan	(2)	[2] 271	[2] 407			
Ferry	[3] 33,227	4,789	27,500	2,170	10,932	81,685
	[3] 33,227	5,060	27,907	2,170	10,932	81,685
Total, 1944	42,245	2,082	11,954	3,504	16,173	104,594

[1] No amalgamation in 1944 or 1945.
[2] Material cyanided was 45,265 tons of current tailings from copper ore.
[3] Includes 774 tons of flotation concentrates cyanided.

Mine production of metals from concentrating mills in Washington in 1945, by counties, in terms of recovered metals

County	Ore treated (short tons)	Concentrates smelted and recovered metal					
		Concentrates produced (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Chelan	617,120	30,466	39,936	120,075	11,605,600		4,837,600
Ferry	172	20		315	2,800	3,500	11,000
Okanogan	12,150	296		24,003	21,200	216,500	87,200
Pend Oreille	253,884	19,194		11,191		7,011,000	15,588,000
Stevens	31,605	2,985	4	5,854	1,356	331,479	2,839,520
	914,931	52,961	39,940	161,438	11,630,956	7,562,479	23,363,320
Total, 1944	1.118,318	58,680	26,580	188,522	12,323,847	11,450,570	23,808,000

Gross metal content of concentrates produced from ores mined in Washington in 1945, by classes of concentrates smelted

Class of concentrate	Concentrates produced (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	2,170	10,932	81,685			
Copper	25,189	39,600	116,571	11,821,116		1,511,300
Lead	5,410	2	37,021	27,429	7,482,856	290,617
Zinc	22,333	337	5,399	158,853	304,902	25,824,001
Zinc-lead	19	1	2,192	442	20,722	5,400
Zinc-lead-copper	10		255	2,840	3,065	3,280
	55,131	50,872	243,123	12,010,680	7,811,545	27,634,598
Total, 1944	62,184	42,753	293,748	12,765,333	12,246,145	28,755,303

Mine production of metals from Washington concentrates shipped to smelters in 1945, in terms of recovered metals

BY COUNTIES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Chelan	30,466	39,936	120,075	11,605,600	----------	4,837,600
Ferry	2,190	10,932	82,000	2,800	3,500	11,000
Okanogan	296	----------	24,003	21,200	216,500	87,200
Pend Oreille	19,194	----------	11,191	----------	7,011,000	15,588,000
Stevens	2,985	4	5,854	1,356	331,479	2,839,520
	55,131	50,872	243,123	11,630,956	7,562,479	23,363,320
Total, 1944	62,184	42,753	293,116	12,323,847	11,450,570	23,808,000

BY CLASSES OF CONCENTRATES

	Concentrates (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry gold	2,170	10,932	81,685	----------	----------	----------
Copper	25,189	39,600	116,571	11,500,600	----------	----------
Lead	5,410	2	37,021	13,350	7,364,456	234,170
Zinc	22,333	337	5,399	114,302	174,640	23,122,158
Zinc-lead	19	1	2,192	376	20,360	4,375
Zinc-lead-copper	10	----------	255	2,328	3,023	2,617
	55,131	50,872	243,123	11,630,956	7,562,479	23,363,320

Gross metal content of Washington crude ore shipped to smelters in 1945, by classes of ore

Class of ore	Ore (short tons)	Gross metal content				
		Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	18,551	1,909	9,383	----------	----------	----------
Copper	38	4	218	11,299	----------	----------
Zinc-lead	103	1	813	52	42,226	27,768
	18,692	1,914	10,414	11,351	42,226	27,768
Total, 1944	20,099	2,383	16,531	16,206	203,309	----------

Mine production of metals from Washintgon crude ore shipped to smelters in 1945 in terms of recovered metals

BY COUNTIES

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Chelan	4,376	243	952	----------	----------	----------
Ferry	14,123	1,642	8,099	----------	----------	----------
Okanogan	47	22	311	----------	----------	----------
Pierce	5	2	21	----------	----------	----------
Snohomish	38	4	218	11,000	----------	----------
Stevens	103	1	813	44	41,521	22,680
	18,692	1,914	10,414	11,044	41,521	22,680
Total, 1944	20,099	2,383	16,531	14,153	199,430	----------

BY CLASSES OF ORE

	Ore (short tons)	Gold (fine ounces)	Silver (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)
Dry and siliceous gold	18,551	1,909	9,383	----------	----------	----------
Copper	38	4	218	11,000	----------	----------
Zinc-lead	103	1	813	44	41,521	22,680
	18,692	1,914	10,414	11,044	41,521	22,680

REVIEW BY COUNTIES AND DISTRICTS

Mine production of gold, silver, copper, lead, and zinc in Washington in 1945, by counties and districts, in terms of recovered metals

County and district	Mines producing		Ore sold or treated (short tons)	Gold (lode and placer) (fine ounces)	Silver (lode and placer) (fine ounces)	Copper (pounds)	Lead (pounds)	Zinc (pounds)	Total value
	Lode	Placer							
Benton County:									
Columbia River	-----	1	-----	11	-----	-----	-----	-----	$385
Chelan County:									
Chelan Lake	1	-----	617,120	40,207	120,482	11,605,600	-----	4,837,600	3,616,001
Wenatchee River	1	-----	4,376	243	952	-----	-----	-----	9,182
Ferry County:									
Orient	1	-----	172	-----	315	2,800	3,500	11,000	2,168
Republic	4	-----	48,746	17,363	117,284	-----	-----	-----	691,107
Kittitas County:									
Yakima River	-----	1	-----	2	-----	-----	-----	-----	70
Okanogan County:									
Loomis-Oroville	2	-----	12,158	4	24,006	21,200	216,500	87,200	48,720
Methow	1	-----	39	18	308	-----	-----	-----	849
Pend Oreille County:									
Metaline	3	1	253,884	1	11,191	-----	7,011,000	15,588,000	2,403,559
Pierce County:									
Mt. Rainier	1	-----	5	2	21	-----	-----	-----	85
Snohomish County:									
Index	2	-----	28	2	190	9,200	-----	-----	1,447
Stilaguamish	1	-----	10	2	28	1,800	-----	-----	333
Stevens County:									
Bossburg	2	-----	2,180	5	6,030	1,400	316,500	25,800	34,838
Coleville-Middleport	1	-----	45	-----	31	-----	200	15,800	1,856
Northport	1	-----	29,483	-----	606	-----	56,300	2,820,600	329,642
Total Washington	21	3	968,246	57,860	281,444	11,642,000	7,604,000	23,386,000	7,140,242

BENTON COUNTY

The metal output of Benton County in 1945 was 11 ounces of placer gold from a small-scale hand operation along the Columbia River near Paterson.

CHELAN COUNTY

Chelan Lake district.—The Holden mine of the Howe Sound Co. again was the leading producer of gold and copper in Washington in 1945 and moved to first place in silver and to third place in zinc output. Ore production dropped nearly 140,000 tons from 1944, but the grade was higher so that outputs of recoverable gold, silver, and zinc were greater than in 1944, and copper was only slightly lower. The company operated its 2,000-ton concentrator continuously on a three-shift basis and treated 617,120 tons of zinc-copper ore. The 25,189 tons of copper concentrate, rich in gold and silver, were shipped to the copper smelter at Tacoma, Wash.; 5,277 tons of zinc concentrate went to the Sullivan zinc plant at Kellogg, Idaho. In addition, 45,265 tons of current tailings were treated by cyanidation and the precipitates shipped to the Selby (Calif.) smelter. Development completed during the year comprised 4,559 feet of drifts, 681 feet of raises, and 8,041 feet of diamond drilling. According to the company printed annual report for the year ended December 31, 1945, employment in the mine reached an all-time low during the summer months, and development was suspended entirely. All the reserve of low-grade ore, which had been subject to premium payment for its copper content, was mined during the first half of the year, and thereafter ore of normal grade was produced from the 1,775 level.

Wenatchee River district.—Knob Hill Mines, Inc., conducted exploration and sampling at the Gold King and MacBeth mines near Wenatchee and shipped highly siliceous gold ore to the Tacoma smelter.

FERRY COUNTY

Orient district.—Glen L. Brink and associates operated the Talisman-Snowbank groups at Laurier and hauled 172 tons of zinc ore to the Gibbs concentration mill near Colville. A 50-ton flotation mill was being constructed on the property in February 1946.

Republic district.—In 1945 over 91 percent of the State total gold ore came from the Republic district, but production was considerably less than in 1944. Knob Hill Mines, Inc., operated its mine throughout the year and produced nearly three-fourths of the ore mined in the district. The company 400-ton cyanidation-concentration mill was operated continuously 7 days a week on a one-shift basis; flotation tails were treated by cyanidation, using agitation and countercurrent decantation. The concentrate was shipped to the Tacoma smelter until late in the year, after which the flotation concentrate was cyanided and the bullion shipped to the Seattle Assay Office. Development on the property consisted of 500 feet of drifts. Lessees worked the Aurum group and shipped several cars of highly siliceous gold ore to the Tacoma smelter. During the year, 580 feet of drifts were driven. Everett Houghland operated the Republic dump from June to October and shipped 2,620 tons of siliceous gold ore to the Tacoma smelter. C. M. Trevitt and E. J. Pierce shipped 8,376 tons of siliceous ore (mostly dump) from the South Penn mine to the Tacoma smelter.

KITTITAS COUNTY

The only production in Kittitas County in 1945 was a small quantity of placer gold recovered from gravel along the Yakima River.

OKANOGAN COUNTY

Loomis-Oroville district.—In 1945 the Kaaba-Texas Mining Co. produced zinc-lead ore from its Kaaba mine at half the 1944 rate. The recoverable metal content of the ore, all treated in the company mill, averaged slightly lower than in 1944. The remaining production from the district consisted of 8 tons of gold ore shipped to the Tacoma smelter by A. D. Heffernar.

Methow district.—The only operator in the Methow district in 1945 was Franklin C. Blocksom, who shipped 39 tons of gold ore from the Minnie Copper-Zinc mine to the Tacoma smelter. The ore yielded 18 ounces of gold and 308 ounces of silver.

PEND OREILLE COUNTY

Metaline district.—The Metaline district produced 95 percent of the State total zinc-lead ore in 1945. The value of recoverable metals declined from $2,961,173 in 1944 to $2,403.559 in 1945, in spite of slightly higher average prices for lead and zinc. Not only did ore production slump, but the recoverable content of lead dropped appreciably; zinc content held steady.

The Pend Oreille Mines & Metals Co. operated its Josephine, Hortense, Sullivan, and Yellowhead groups throughout the year and treated 116,696 tons of zinc-lead ore in the company 750-ton flotation mill. Concentrates produced comprised 1,665 tons of lead concentrate shipped to the Bunker Hill smelter and 5,002 tons of zinc concentrate, most of which was smelted at La Salle, Ill. Manpower shortages forced curtailment of development which, during the year, comprised 559 feet of drifts, 383 feet of raises, and 5,792 feet of diamond drilling.

The Grandview mine of the American Zinc, Lead & Smelting Co. operated continuously in 1945 but at a slightly reduced rate compared with 1944. According to the company printed annual report for the year ended December 31, 1945, 93,870 tons of milling ore were produced, which were concentrated into 8,699 tons of zinc and lead concentrates. Manpower shortage retarded production and much-needed underground development and made it impossible to maintain the mine in a properly developed condition.

In 1945 the property worked by the Metaline Mining & Leasing Co. ranked fourth in zinc output and third in lead among State producers. Ore production from the property dropped about 18 percent below that in 1944. The ore was milled in the Grandview 600-ton mill, and the lead concentrate was shipped to the Bunker Hill smelter and the zinc concentrate to the Great Falls, Mont., and Dumas, Tex., electrolytic zinc plants. Development during the year comprised 1,587 feet of drifts and 10,947 feet of diamond drilling.

PIERCE COUNTY

Mount Rainier district.—Five tons of gold ore shipped to the Tacoma smelter from the Silver Creek mine constituted the metal production of Pierce County in 1945.

SNOHOMISH COUNTY

Index district.—Two producers in 1945 shipped to the Tacoma smelter a total of 28 tons of copper ore, which contained 2 ounces of gold, 190 ounces of silver, and 9,444 pounds of copper.

STEVENS COUNTY

Bossburg district.—Victory Metals, Inc., assumed operation of the Bonanza mine from Russell Parker in July 1945 and during the last quarter of the year treated about 1,800 tons of lead ore in the Bonanza mill. Sam Halsey spent most of the year developing the Young America mine and shipped 19 tons of zinc-lead concentrate and 10 tons of zinc-lead ore to the Bunker Hill smelter and 18 tons of zinc concentrate to the Sullivan zinc plant.

Coleville-Middleport district.—DaRoy Metals Co., working the Northwest zinc mine, shipped 45 tons of zinc ore to the Bauer, Utah, plant of Combined Metals Reduction Co. for treatment. The concentrate contained 31 ounces of silver, 278 pounds of lead, and 16,065 pounds of zinc.

Northport district.—From the Deep Creek mine the Jamison-Higginbotham Mining Co. produced 29,390 tons of zinc ore and 93 tons of zinc-lead ore. The zinc ore was treated in the Blue Ridge flotation mill on Deep Creek, owned by the Sierra Zinc Co., and the zinc-lead ore was shipped direct to a smelter. The concentrate produced (2,695 tons) contained 565 ounces of silver, 21,804 pounds of lead, and 3,086,350 pounds of zinc, and the crude ore shipped contained 41 ounces of silver, 35,894 pounds of lead, and 25,200 pounds of zinc. No other production was reported from this district in 1945.

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GOLD, SILVER, COPPER, AND LEAD IN WYOMING

(MINE REPORT)

By G. E. Woodward

SUMMARY OUTLINE

SUMMARY

The total value of gold, silver, and lead recovered from ores mined in Wyoming in 1945 was $608, compared with gold and silver valued at $702 in 1944. Two mines accounted for the 1945 production. The Esterbrook Lead Mining Co. shipped 15 tons of lead ore, yielding 17 fine ounces of silver and 6,000 pounds of lead, from its Esterbrook and Douglas mining claims in Albany County near Esterbrook; the ore was shipped to a lead smelter at Midvale, Utah. Harry Ferguson made a test shipment of 37 tons of dry and siliceous gold ore from the Bartlett (formerly Copper King) mine in the Silver Crown district, Laramie County. The ore yielded 2 fine ounces of gold and 14 fine ounces of silver and was shipped crude to a Garfield, Utah, smelter.

All tonnage figures are short tons and "dry weight"; that is, they do not include moisture.

The value of the metal production herein reported has been calculated at the following prices.

Prices of gold, silver, copper, lead, and zinc, 1941–45

Year	Gold [1]	Silver [2]	Copper [3]	Lead [3]	Zinc [3]
	Per fine ounce	*Per fine ounce*	*Per pound*	*Per pound*	*Per pound*
1941	$35.00	[4] $0.711+	$0.118	$0.057	$0.075
1942	35.00	[4] .711+	.121	.067	.093
1943	35.00	[4] .711+	.130	.075	.108
1944	35.00	[4] .711+	.135	.080	.114
1945	35.00	[4] .711+	.135	.086	.115

[1] Price under authority of Gold Reserve Act of Jan. 31, 1934. Treasury legal coinage value of gold from Jan. 18, 1837, to Jan. 31, 1934, was $20.67+ ($20.671835) per fine ounce.
[2] Treasury buying price for newly mined silver.
[3] 1941: Yearly average weighted price of all grades of primary metal sold by producers; 1942–45: Price includes bonus payments by Metals Reserve Company for overquota production.
[4] $0.71111111.

The following table shows the annual output of ore from lode mines producing gold, silver, copper, and lead and the quantity and value of the metals recovered from both lode and placer mines in Wyoming from 1941 to 1945; it also gives the total production of metals from 1867 to 1945.

Mine production of gold, silver, copper, and lead in Wyoming, 1941–45, and total, 1867–1945, in terms of recovered metals

Year	Ore (short tons)	Gold (lode and placer)		Silver (lode and placer)		Copper		Lead		Total value
		Fine ounces	Value	Fine ounces	Value	Pounds	Value	Pounds	Value	
1941	159	478	$16,730	94	$67	8,000	$944			$17,741
1942	84	23	805	52	37			6,000	$402	1,244
1943										
1944	6	20	700	3	2					702
1945	52	2	70	31	22			6,000	516	608
1867–1945	(1)	77,936	1,836,088	74,666	51,776	[2] 16,325	5,684,048	[2] 14	1,486	7,573,398

[1] Figures not available.
[2] Short tons.

A summary of the past production of Wyoming shows that the State has produced gold, silver, copper, and lead valued at $7,573,398 during the period 1867 to 1945. Gold and silver have been produced from many localities throughout the State, whereas the output of copper (most of which was mined prior to 1924 and accounts for over three-fourths of the total recorded value of the four metals) has come from the Encampment district, in Carbon County, and the Hartville district, originally in Laramie County, now in Platte County. All the lead produced in the State before 1945 came from the Spring Creek district in Carbon County and the Hurricane district in Crook County and was mined during 1932, 1934, 1935, and 1942.

SECONDARY METALS—NONFERROUS

By Herbert L. Cullen and A. J. McDermid [1]

SUMMARY OUTLINE

GENERAL SUMMARY

The recovery of nonferrous secondary metals from purchased scrap continued in 1945 at the high level engendered by war production, with slight gains recorded for most of the metals surveyed except the light metals aluminum and magnesium. The aluminum and magnesium industries were the first to suffer cuts in production and were slower to invade civilian markets, while the other metals with established uses in civilian products were in continued demand throughout the year. In general, the recovery of metal from new scrap was less than in the preceding year, and the recovery from old scrap was higher, illustrating the decline in the volume of production scrap and the increased return of old scrap from all sources for remelting. This gain in the ratio of old scrap to new scrap used continued the trend indicated in the preceding year and marked a drift toward the prewar ratio after the abnormally high use of new scrap during the war years.

Salient statistics of nonferrous secondary metals recovered in the United States, 1944–45

Metal	New scrap		Old scrap		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Aluminum	302,746	$86,706,454	22,899	$6,558,274	325,645	$93,264,728
Antimony	328	103,910	15,558	4,928,775	15,886	5,032,685
Copper	494,232	116,638,752	456,710	107,783,560	950,942	224,422,312
Lead	41,483	5,309,824	289,933	37,111,424	331,416	42,421,248
Magnesium	[1] 13,976	[1] 5,730,160	[1] 209	[1] 85,690	14,185	5,815,850
Nickel	2,123	1,486,100	2,198	1,538,600	4,321	3,024,700
Tin	11,240	11,689,600	21,349	22,202,960	32,589	33,892,560
Zinc	232,308	39,956,976	113,161	19,463,692	345,469	59,420,668
	----------	[1] 267,621,776	----------	[1] 199,672,975	----------	467,294,751
1945						
Aluminum	271,076	77,473,521	27,311	7,805,484	298,387	85,279,005
Antimony	2,097	664,330	15,051	4,768,157	17,148	5,432,487
Copper	446,701	105,421,436	559,815	132,116,340	1,006,516	237,537,776
Lead	52,210	6,682,880	310,829	39,786,112	363,039	46,468,992
Magnesium	8,422	3,453,020	825	338,250	9,247	3,791,270
Nickel	4,251	2,975,700	2,232	1,562,400	6,483	4,538,100
Tin	11,156	11,602,240	23,977	24,936,080	35,133	36,538,320
Zinc	238,847	41,081,684	121,597	20,914,684	360,444	61,996,368
	----------	249,354,811	----------	232,227,507	----------	481,582,318

[1] Corrected figures.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

The total value of metals recovered in 1945 from both new and old scrap was $481,582,318, compared with $467,294,751 in 1944. This gain was due entirely to the increased value of metals recovered from old scrap—from $199,672,975 (corrected figure) in 1944 to $232,227,-507 in 1945; in contrast, the value of metals reclaimed from new scrap declined from $267,621,776 (corrected figure) in 1944 to $249,354,811 in 1945.

Secondary metals recovered as unalloyed metal, in alloys, and in chemical compounds in the United States, 1941–45, in short tons

Metal	1941	1942	1943	1944	1945
Aluminum	106, 857	196, 464	313, 961	325, 645	298, 387
Antimony	21, 629	18, 200	15, 483	15, 886	17, 148
Copper	726, 396	927, 755	1, 086, 047	950, 942	1, 006, 516
Lead	397, 416	323, 001	342, 094	331, 416	363, 039
Magnesium	1, 752	6, 238	11, 404	14, 185	9, 247
Nickel	5, 315	4, 142	6, 917	4, 321	6, 483
Tin	42, 033	37, 918	37, 820	32, 589	35, 133
Zinc	283, 967	330, 526	368, 488	345, 469	360, 444

When wartime demands for metals exceeded supply, the use of critical and strategic metals had to be restricted to essential applications. Better utilization of materials was the common aim and was achieved in several ways. Where specifications seemed too rigid, emergency alternate specifications were introduced, not on a mandatory but on a voluntary basis. Some revisions allowed changes in the basic composition of alloys or substitution of one metal for another; others raised the impurity limits. The aftereffects of these wartime changes, substitutions, and down gradings have been analyzed in an article by C. S. Cole of The American Society for Testing Materials.[2]

Changes in specifications for wrought-copper alloys were made to permit the use of high-grade fire-refined copper and to remove restrictions on the use of scrap of known purity. No longer did Federal specifications say: "Only primary metal shall be used." They said, instead: "The metal used shall be such as to meet the chemical requirements of this specification." That change applied to all metals.

Plants that had been obtaining desired compositions by mixing primary metals began to utilize scrap and ingot when they could not get virgin material, such as copper or tin. As alloy ingot is made chiefly from scrap, this practice increased the consumption of scrap by brass ingot makers. Some practices adopted when materials were scarce were abandoned when the supply became more abundant. The steel cartridge-case program, for instance, was dropped when copper became more plentiful late in the war. Many wartime changes in metallurgical practice, however, were continued in peacetime procedure; this applied especially to changes that were made to conserve tin and those that permit the use of scrap in place of primary metal. Before the war many items were being made of high-tin bronze, requiring all or nearly all new metal, when yellow brass or even a ferrous metal would do. In addition, experimentation with low-tin babbitts has proved their suitability in many uses formerly reserved for high-tin babbitts.

[2] Cole, C. S., Impact of War on Nonferrous Specifications: Metal Prog., October 1945, pp. 684–692.

Some of the new alloys introduced commercially during 1945 included an age-hardening copper-manganese-nickel alloy (No. 720), which was designed for use in springs; Phosnic, a precipitation-hardening nickel-phosphor bronze that is hot- and cold-workable and corrosion-resistant; and copper alloys containing tellurium.

In general, these changes in specifications and improvements in metallurgical practice represent advances in efficient utilization of metal resources, whether of primary or secondary origin. Many of the changes will be discarded when critical materials again become plentiful, but there is little doubt that a number will be retained.

SCOPE OF REPORT

Data on scrap and secondary metals for 1945 were derived from a number of surveys covering all known consumers of purchased nonferrous scrap metals and a representative group of dealers. For the first time, consumption of copper-base scrap, copper-alloy ingot, and refined copper was incorporated in a single report so that consumers could report consumption of copper in all forms on one schedule. Reports on consumption of copper materials were received from 106 plants classed as remelters, smelters, or refiners and from 2,456 plants classed as brass mills, foundries, wire mills, chemical works, and miscellaneous manufacturers. The large consumers of scrap in the secondary lead, zinc, and aluminum industries were canvassed on a monthly basis by the Bureau of Mines, and additional information was received on annual reports from 1,156 foundries, aluminum rolling mills, and other manufacturers concerning all types of nonferrous scrap except copper-base scrap. In all, 392 plants were represented in the group classed as remelters, smelters, or refiners. In the monthly dealer survey, approximately 2,100 companies were canvassed until August, when the mailing list was cut to some 1,300 companies to relieve the reporting burden on this group as much as possible.

Definitions of the terms used in this chapter are as follows:

"Secondary metals" are metals or alloys recovered from scrap and residues. The term "secondary" applies only to the source of metal and has no relation to the type of product recovered, either as to degree of purity or impurity or physical characteristics.

"Purchased scrap" means all scrap that entered any plant in scrap form and includes scrap treated for customers upon a toll basis or conversion agreement and interplant transfers of scrap. Scrap salvaged by railroads from line operations and melted in their own foundries and that melted by Navy Yard foundries which originated in salvage operations are included in this category, as a definite recovery of secondary metal results from the melting of such scrap.

"Interplant transfers" are those made between separate plants owned or operated by the same parent company but not located on the same ground. A transfer of scrap from a machine shop to a foundry at the same plant location is not an interplant transfer, and such "home scrap" is not included in this report. In some isolated instances where a foundry and a brass mill, or a brass mill and a wire mill, were operated at the same general location, it has been necessary to record scrap transferred from one operation to the other and include its consumption in these surveys.

"New scrap" is defined as the refuse produced during the manufacture of articles for ultimate consumption, including all defective finished or semifinished articles that must be reworked. Typical examples of new scrap are defective castings, clippings, punchings, turnings, borings, skimmings, drosses, and slag.

"Old scrap" is defined as scrap consisting of metal articles that have been discarded after serving a useful purpose. Typical examples of old scrap are discarded trolley wire, battery plates, railroad-car boxes, fired cartridge cases, automobile crankcases, used pipe, and lithographers' plates.

SECONDARY ALUMINUM

The recovery in 1945 of 298,387 short tons of aluminum, valued at $85,279,005, from scrap, though very large by prewar standards was well below the record 325,645 tons valued at $93,264,728 recovered in 1944. Values were calculated for 1944 on the basis of the replacement value of primary aluminum at 14.32 cents a pound. For 1945 the price per pound used was 14.29 cents, which was the calculated average market price of all grades of primary ingot and pig.

Secondary aluminum[1] *recovered in the United States, 1944–45, in short tons*

Secondary aluminum recovered			Recoverable aluminum-alloy content of scrap		
Form of recovery	1944	1945	Kind of scrap processed	1944	1945
As metal	2,336	2,145	New scrap:		
Aluminum alloys	320,040	293,967	Aluminum-base[2]	302,230	270,810
In brass and bronze	1,466	1,162	Copper-base	429	107
In zinc-base alloys	187	267	Zinc-base	87	159
In chemical compounds	1,616	846			
				302,746	271,076
	325,645	298,387	Old scrap:		
			Aluminum-base[3]	22,359	26,712
			Copper-base	440	491
			Zinc-base	100	108
				22,899	27,311
				325,645	298,387

[1] In accordance with common usage, the term "aluminum" covers aluminum alloys, and the figures include all constituents of the alloys recovered from aluminum-base scrap.
[2] Recoverable aluminum content of new aluminum-base scrap was 281,804 tons in 1944 and 252,098 tons in 1945.
[3] Recoverable aluminum content of old aluminum-base scrap was 20,495 tons in 1944 and 24,527 tons in 1945.

Although the recoverable aluminum-alloy content of the total scrap consumed declined, the recoverable content of the old scrap used rose because of increased recovery from aircraft scrap. The aluminum recovered in aluminum alloys constituted over 98 percent of the total aluminum salvaged from all classes of scrap both in 1945 and 1944. Aside from its use as metal and in aluminum alloys, aluminum is used in a few chemicals (of which aluminum chloride is the most important), in manganese and aluminum bronze, and in zinc die castings. It constitutes about 10 percent of aluminum bronze, 5 percent of manganese bronze, and 4 percent of zinc die castings.

Production of secondary aluminum and aluminum-alloy products in the United States, 1943–45, gross weight, short tons

	1943	1944	1945
Secondary aluminum ingot:[1]			
Pure aluminum (98.5 percent)	715	1,151	2,066
Silicon (max. Cu, 1 percent)	471	2,885	10,618
Silicon (Cu, 1 to 2.5 percent)	13,348	14,600	14,635
No. 12 aluminum	11,302	19,735	22,674
Other aluminum-copper (max. Si, 2.5 percent) alloys	25,160	9,772	26,360
Copper-silicon (each over 2.5 percent) alloys	24,861	20,744	50,983
Aluminum-copper- or aluminum-silicon-nickel alloys		11,864	18,208
Deoxidizing and other destructive uses	32,770	48,652	44,175
Die-casting alloys	8,390	22,631	(2)
Aluminum hardeners	6,267	5,961	3,964
Wrought alloys	45,063	21,651	(2)
"Primary-grade" ingot	1,401	17,078	(2)
Ingot for chemicals, powder, etc	14,536	5,638	(2)
Piston alloys	10,295	11,815	(2)
Miscellaneous (and Mg and Zn alloys)	1,794	702	4,743
	[3] 196,373	[3] 214,879	198,426
Secondary aluminum at primary plants [4]	121,827	[5] 124,108	108,705
Aluminum powder	961	[6] 346	[6] 79
Aluminum-alloy castings	448	[5] 1,134	2,555
Aluminum in chemicals	1,180	1,616	846

[1] Gross weight of alloys, including copper, silicon, and other added elements; total secondary ingot contained 8,471 tons of primary aluminum in 1943, 8,792 tons in 1944, and 6,816 tons in 1945.
[2] Production for 1945 included under other classifications.
[3] Includes 18,552 tons produced on toll in 1943 and 9,089 tons in 1944.
[4] Combined with primary aluminum for the production of wrought products and castings.
[5] Revised figures.
[6] Does not include production measured as ingot for graining, powder, atomizing, or chemical purposes.

Production of remelt aluminum ingot, which had risen rapidly in the war years, decreased from 214,879 tons in 1944 to 198,426 tons in 1945. The obvious cause for the decrease in activity was the cessation of hostilities with Germany and Japan, which resulted in curtailment of demand for both primary and secondary aluminum. Monthly ingot production exhibited a rising trend for the first 3 months of the year, increasing about 5,000 tons in that period. Output then fell from 20,644 tons in March to 10,916 tons in September, the low point of the year, and rose moderately during the final quarter, when the price of high-grade ingot rose in some markets to 13.5 and 14 cents a pound.

As the data in the production table for 1944 were assembled from a War Production Board canvass and those for 1945 from Bureau of Mines surveys, the two sets of figures are not fully comparable. In the Bureau questionnaire which replaced Form WPB–554, the number of items both for scrap and ingot was drastically reduced to lessen the time and effort that the industry had to devote to completing the reports. Ingot for chemicals, powder, etc., which included aluminum employed in chemical warfare, incendiary bombs, and other war uses, appears in the table as a separate item for 1943 and 1944 but was combined with ingot used for deoxidizing and other destructive uses in the column for 1945. The quantity used for war purposes would naturally decline after cessation of hostilities, but that fact is not evident from the table. Other items omitted in the 1945 column were combined in a similar manner. Information obtained from the monthly aluminum-scrap survey indicated that there was a decreasing trend during the year in the production of alloys containing nickel and of ingot made for deoxidizing and other destructive uses and a rising trend in output of No. 12, the general-purpose casting alloy.

New artificial aging-treatment technique, which was developed during 1945, resulted in improving the properties of a number of the high-strength wrought alloys, including 75S and R301, which were introduced in 1943 and 1944, and 24S. Alloy 63S was developed in 1945 and was designed particularly for architectural and building applications. Aluminum casting alloys containing beryllium and cobalt were shown to have superior strength properties, together with high thermal stability and unusual oxidation resistance. Another alloy introduced in 1945, R317, is a free-machining material with mechanical properties similar to 17S. The metallurgical problems connected with reclaiming aluminum from aircraft scrap with caustic soda solution were solved during the year, but the process did not appear to have much possibility of commercial success because of scrap transportation costs. An article by Colwell [3] compares returns from several procedures, including the caustic soda method, for disposing of air-frame scrap. Among the new civilian uses for aluminum alloys that were introduced during 1945 were a new type of roofing sheet, aluminum piano plates, and a number of developments in cargo and travel equipment. A survey conducted by the Aluminum Association showed that the number of uses of aluminum had increased to approximately 3,500 compared with some 2,000 before the war.

In 1945, plants producing primary metal recovered 108,705 tons of aluminum from scrap, which was combined with the much larger primary aluminum production and used by rolling mills and foundries to make sheet, bar, extruded shapes, castings, and other similar products. Since so many aluminum alloys can be used for both wrought products and castings, it was not possible to determine the proportions of secondary aluminum used for the two purposes.

Aluminum-ingot makers consumed 323,676 tons of aluminum scrap in 1945, or 9 percent less than in 1944. Decreases were registered in all categories except castings and forgings and aircraft scrap. One cause of the lowered consumption of new scrap was the curtailment of scrap generators' operations, on account of contract terminations and strikes. Melting of aircraft scrap totaled 15,840 tons in 1945 compared with 7,755 tons in 1944, and the increase in treatment of this scrap caused the total consumption of old scrap to rise to 32,031 tons, which is 6,808 tons more than the same total for 1944. The Navy Department increased its consumption of this material at six naval air stations from 2,278 tons in 1944 to 5,994 tons in 1945. The work at these stations helped considerably in solving the problems of storage and disposal of the large accumulation of aircraft which became obsolete and surplus when the war ended. Improvements in metallurgical technique by the Navy produced ingot from aircraft scrap that contained less than 1 percent iron, 4 or 5 percent copper, about 1 percent magnesium, and smaller percentages of other metals. This ingot was readily usable for castings and wrought products of similar

[3] Colwell, Donald L., Navy Recovers Aluminum from Aircraft: Modern Metals, vol. 1, No. 9, October 1945, pp. 8–12.

composition. Of the total scrap consumed, 207,135 tons (64 percent) were used by ingot makers at 70 plants. To bring their products to specified compositions they used 6,816 tons of primary aluminum, 2,010 tons of copper and brass scrap, and 4,664 tons of other alloying ingredients, such as zinc and magnesium.

Consumption of purchased aluminum scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Aluminum rolling mills		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
Pure clippings, wire, and foil	6,986	115	1,925		388	6	9,420
Castings and forgings	19,384	10,910	8,901		434	1,214	40,843
Alloy sheet	39,713	1,083	92,073	1,010	11	30	133,920
Scrap sheet and sheet utensil		1,329			10	107	1,446
Borings and turnings	98,316		5,120		682		104,118
Die castings					245	96	341
Aircraft scrap		12,198		3,612		30	15,840
Miscellaneous aluminum and dross	16,810	291			647		17,748
	181,209	25,926	108,019	4,622	2,417	1,483	323,676

During the year the WPB and the Surplus Property Administration issued a number of directives, which had the effect of removing or liberalizing restrictive orders on the use of aluminum scrap and ingot, and the Office of Price Administration made some additions to and changes in ceiling prices. On January 29 a flat maximum price of 18 cents a pound was established for scrap generated in the fabrication of aluminum products and suitable for use without remelting. Plants were allowed to sell this material to dealers at the same maximum prices as to fabricators. In the same directive, the method for computing charges for toll operations on scrap was amended and clarified. On January 18 the Metals Reserve Company was authorized to sell, for war-production purposes, aluminum scrap being held in Government storage. This was done on advice from the WPB Metals Division that recent changes in the progress of the war had caused an increase in the need for products made from aluminum. On May 5 an amendment to Maximum Price Regulation 2 was issued that is of special interest because of the definitions it contains. Aluminum scrap was defined to include all aluminum and aluminum-alloy materials that are the waste or byproduct of any kind of metal working, as well as any materials that have been discarded from inventory or use because of obsolescence, failure, or other reasons and that are to to be remelted for further use. Secondary aluminum ingot means all ingots, alloys and hardeners containing 50 percent or more aluminum by weight and produced from 50 percent or more of scrap materials. A hardener is an intermediate alloy that is not suitable for direct use without combination with other materials and that is designed to facilitate the introduction of one or more of the constituent metals into other alloys. The Controlled Materials Plan was partly relaxed on June 13 to permit aluminum producers to fill unrated orders for aluminum products except extrusions, provided such orders did not interfere with delivery of authorized material on orders they had been specifically directed to fill.

Consumers' stocks of purchased aluminum-base scrap in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1944	Dec. 31, 1945
Castings and forgings	1,689	9,904
Sheet, turnings, clippings, etc	12,367	15,006
Aircraft scrap	(1)	10,551
Miscellaneous aluminum and dross	1,611	2,128
	15,667	37,589

1 Combined with sheet, turnings, clippings, etc., in 1944.

On October 10 the Surplus Property Administration established price limits below which aluminum scrap in contractor inventories could not be sold but would be stock-piled in Government storage depots. Minimum prices laid down in the regulation were as follows: (a) Pig or ingot resulting from melting of obsolete or wrecked aircraft, 6 cents a pound; (b) segregated solids (plant or production scrap or any other solids consisting of only one alloy and so identified), 6 cents; pure cable (clean and free of iron), 6 cents; foil (clean and new), 6 cents; (c) mixed solids (plant or production scrap consisting of an unknown alloy or consisting of more than one alloy), 5 cents; obsolete castings and forgings (alloy unknown or not segregated), 5 cents; obsolete pistons (alloy unknown or not segregated), 5 cents; any other clean solids free of all metal other than aluminum, 5 cents; (d) solids mixed with foreign materials (any scrap, other than as defined in paragraphs (e) and (f) that is contaminated by or mixed with foreign materials), 4 cents; (e) prepared aircraft scrap (not including engines or engine parts) recovered from wrecked, crashed, obsolete, or uncompleted air frames cut or sheared into pieces approximately 48 by 60 by 24 inches or less and shipped in 30,000-pound minimum cars, 2½ cents; (f) wrecked, crashed, obsolete, or uncompleted air frames to be scrapped (without preparation of any kind), 1¼ cents.

On November 15, the Surplus Property Administration issued Regulation 17, defining the policy to be followed by Government agencies in stock-piling surplus strategic materials. The reserves of Government-owned surplus property needed to cover civilian deficiencies were to be estimated by the Civilian Production Administration (successor to the War Production Board November 3) and would then be available for disposal. The screening of surplus property, to determine what should be stock-piled and what disposed of, was delegated to the Reconstruction Finance Corporation and the Army and Navy Munitions Board.

Ceiling prices for secondary aluminum ingot were the same in 1945 as they had been in 1944, the price for high-grade secondary ingot being 12.50 cents. On November 20 aluminum scrap and secondary ingot were both removed from price control. Dealers' buying prices for cast-aluminum scrap in New York averaged 3.73 cents per pound in 1945, which was 0.31 cent below the 1944 average of 4.04 cents and the lowest yearly average since 1932. The average quotation for January was 3.58 cents; but by February the price was up to 3.75 cents, where it remained throughout the year. The average price for new aluminum clippings was 5.83 cents in 1945, an increase of 0.71 cent over the 1944 average of 5.12 cents.

During 1945 scrap-metal dealers purchased 154,726 short tons of aluminum scrap, a decrease of 17 percent from the 186,171 tons received during 1944. Dealers' shipments of aluminum scrap to consumers were 156,804 tons in 1944 and 155,043 tons in 1945. Shipments of aircraft scrap to consumers increased from a monthly average of 107 tons during the first 6 months to a monthly average of 207 tons during the latter half of 1945. Shipments of machinings, borings, and turnings dropped from a monthly average of 7,487 tons during the first half of the year to 3,078 tons during the second half. Stocks held by dealers dropped steadily for the first 8 months, after which gains were recorded, so that at the end of the year stocks of 55,495 tons were only 317 tons below the 55,812 tons on inventory December 31, 1944.

SECONDARY MAGNESIUM

The recovery of secondary magnesium (including alloying ingredients) during 1945 totaled 9,247 short tons, a 35-percent decrease from the 14,185 tons reclaimed in 1944. The value of secondary magnesium recovered in 1945 was $3,791,270 compared with $5,815,850 in 1944, value being computed at 20.50 cents a pound in both years.

Recovery of magnesium from old scrap during 1945 amounted to 9 percent of the total, showing a substantial increase over the 1944 proportion, less than 2 percent of the total. Analysis of the figures for consumption of magnesium scrap by grade reveals a substantial decline in the ratio of borings, turnings, and sawings used to total scrap used—65 percent of the total in 1945, compared with 89 percent in 1944. This indicates that, in spite of war production during the first half of 1945, the ratio of solid magnesium scrap to borings and turnings treated is approaching normal practice and in time will be more like that of the other nonferrous metals.

Secondary smelters produced only 7,835 tons of secondary magnesium-alloy ingot during 1945, compared with 14,419 tons in 1944. This, of course, indicates that the demand for secondary magnesium ingot was very weak during the latter half of the year, experiencing the same decline after the end of hostilities as that for primary magnesium ingot. The 7,835 tons of secondary ingot produced required a blending of 422 tons of primary magnesium and 168 tons of alloying ingredients, in addition to the purchased scrap used.

Secondary magnesium recovered in the United States, 1944–45, in short tons

Secondary magnesium recovered

Form of recovery	1944	1945
Magnesium-alloy ingot[1] (gross weight).	13,379	7,359
Magnesium-alloy castings (gross weight).	235	496
Magnesium-alloy shapes	----------	864
In aluminum alloys	23	274
In zinc alloys	5	3
In other alloys	2	10
Chemical and incendiary uses	541	241
	14,185	9,247

Recoverable magnesium-alloy content of scrap

Kind of scrap processed	1944	1945
New scrap: Magnesium-base	13,976	8,422
	13,976	8,422
Old scrap:		
Magnesium-base	209	697
Aluminum-base	----------	128
	209	825
	14,185	9,247

[1] Figures include secondary magnesium incorporated in primary magnesium ingot.

Although some magnesium foundries reported they were unable to use their own home scrap, such as gates and risers, because of contamination of foundry sand by tiny particles of magnesium oxide and the resulting surface defects on castings, the consumption of purchased magnesium scrap in foundries was more than twice as great in 1945 as in 1944. Recovery of secondary magnesium in magnesium-alloy castings was 496 short tons in 1945 compared with 235 tons in the preceding year. Recovery of secondary magnesium in rolled and extruded products was reported for the first time in 1945. A total of 864 tons of secondary magnesium was recovered in these products, all of it from solid wrought scrap, a pure-magnesium material.

Standardization in the metallurgical treatment of wrecked aircraft scrap made it possible to calculate the recovery of a small quantity of magnesium from this source in 1945, and the figures have been incorporated in the above table showing recovery of secondary magnesium. In addition to this tonnage of magnesium recovered in the melting of aluminum-base scrap, an increased quantity of magnesium scrap was reported used in aluminum alloys. Owing to the end of hostilities, the consumption of magnesium scrap in chemical and incendiary uses declined, the recovery of magnesium in such applications decreasing from 541 tons in 1944 to 241 tons in 1945. Chemical applications included use in fluxing compounds, in the Grignard reaction, and in the production of magnesium nitrate and chloride; and the incendiary uses were in the production of war materials, such as flares and incendiary bombs. As in former years, the fire hazard presented by the storage of magnesium turnings and borings prevented full utilization of this material, and large quantities were disposed of by burning to avoid the risk incident to storage.

Stocks and consumption of magnesium scrap in the United States in 1945, gross weight, in short tons

Scrap item	On hand—		Consumption during 1945
	Dec. 31, 1944[1]	Dec. 31, 1945	
Cast scrap	1,037	1,424	2,107
Solid wrought scrap	19	625	1,644
Borings, grindings, drosses, etc	187	227	6,899
	1,243	2,276	10,650

[1] Revised figures.

Because consumption of magnesium in all forms was declining toward the end of the war, productive capacity exceeded demand for the metal by a substantial margin. As a result, magnesium was free from WPB controls during 1945, except for reporting production and consumption. Even this burden was lifted from industry at the end of the war, the last reports submitted to WPB covering the month of August.

Maximum prices on magnesium scrap and remelt ingot which had been established under OPA Maximum Price Regulation 302 on January 20, 1943, were continued without change until August 31, 1945. On that date OPA issued Suspension Order 129, which lifted the price control on magnesium scrap, primary and secondary magnesium, and magnesium castings. This action was possible because production of these items had expanded during the year, and when the cut-back in the manufacture of aircraft occurred, there was excess capacity for the production of all forms of magnesium. Before controls were suspended, the maximum prices were as follows: New segregated solids were exempt from price ceilings, and segregated borings had a maximum price of 9 cents a pound, mixed borings 8 cents, and mixed solids 12 cents. The ceiling on class A remelt ingot was 21.5 cents a pound.

SECONDARY COPPER AND BRASS

The recovery of secondary copper from scrap totaled 1,006,516 short tons valued at $237,537,776 in 1945, a 6-percent gain over the 950,942 tons valued at $224,422,312 recovered in 1944. The value of copper has remained at 11.8 cents a pound, exclusive of bonus payments under the Premium Price Plan, for the past 5 years.

Recovery of copper from old scrap climbed from 456,710 tons in 1944 to 559,815 tons (56 percent of the total recovered) in 1945, marking a return to the prewar preponderance of old scrap over new scrap. Reclamation of metal from old scrap is regarded as a definite addition to the pool of metal in use and may be combined with the data for imports and domestic mine production in any given year to compute the total addition to the Nation's metallurgical pool for that particular metal. During 1945 the War Department continued to return fired cartridge and shell cases from overseas wherever possible. The salvage units of War and Navy Departments built up an enviable record in the return of this item of old scrap to consumers for remelting during the war years. In addition, a larger proportion of the total yellow brass scrap used in 1945, particularly at brass mills, was reported as being old scrap, indicating that the ratio may swing more heavily toward old scrap during 1946, when worn and obsolete consumer goods are replaced by new products.

Secondary copper recovered in the United States, 1944–45, in short tons

Secondary copper recovered			Recoverable copper content of scrap		
Form of recovery	1944	1945	Kind of scrap processed	1944	1945
As unalloyed copper:			New scrap:		
At primary plants	86,398	96,662	Copper-base	479,244	432,687
At other plants	15,737	16,194	Aluminum-base	14,586	13,211
			Nickel-base	401	803
	102,135	112,856	Tin-base	1	----------
In brass and bronze	814,898	860,287		494,232	446,701
In alloy iron and steel	2,454	2,133			
In aluminum alloys	17,054	12,055	Old scrap:		
In other alloys	1,044	519	Copper-base	454,938	557,884
In chemical compounds	13,357	18,666	Aluminum-base	949	1,204
			Nickel-base	648	503
	848,807	893,660	Lead-base	----------	60
			Tin-base	175	164
	950,942	1,006,516			
				456,710	559,815
				950,942	1,006,516

Recovery of copper from new scrap declined from 494,232 tons in 1944 to 446,701 tons in 1945, even though the total consumption of new scrap in 1945 was slightly larger than in the preceding year. The explanation of this apparent anomaly lies in the fact that a much larger tonnage of low-grade scrap and residues, of which the major portion was new scrap, was available for treatment during 1945. The net recovery of copper from low-grade scrap and residues is low compared with that from other items of scrap.

The production of refined copper (electrolytic grade) from scrap increased from 93,046 tons in 1944 to 98,338 tons in 1945, a 6-percent gain. This increase was largely attributable to the increased use of low-grade residues and refinery brass at primary plants in copper production. Total recovery of unalloyed copper from scrap increased 10 percent—from 102,135 tons in 1944 to 112,856 tons in 1945.

Experiencing a sharp decline after the end of the war, the commercial production of brass and bronze ingot fell from its 1944 record of 518,261 short tons (gross weight) to 378,454 tons in 1945, a 27-percent decline. The 378,454 tons of ingot contained 305,914 tons of copper, of which 18,716 tons were primary refined copper and the rest was recovered from scrap. Total shipments of ingot during the year were 370,398 tons, as stocks at producers' plants increased from 15,135 tons (revised figure) at the beginning of the year to 23,191 tons on December 31. Seventy-one plants produced brass and bronze ingot for sale in 1945, but two foundries that had made ingot for their own use in 1944 discontinued this practice during that year and did not report production in 1945.

Continuing a practice inaugurated in 1943, three brass-ingot makers produced brass-mill billets and cakes from their scrap melts, which were later rolled into finished products at brass mills. These smelters produced 16,653 tons of brass billets for this purpose. Itemization of the tonnage of each type of brass and bronze billets made cannot be published, as this would reveal individual company operations. The production of one plant which operated both a brass-ingot plant and a brass mill is not included in the above figure, since the two operations were tabulated separately in 1945.

Analysis and production of secondary copper and copper-alloy products in the United States, 1944–45

Item produced from scrap	Approximate analysis (percent)						Gross weight produced (short tons)	
	Cu	Sn	Pb	Zn	Ni	Al	1944	1945
Refined copper (electrolytic grade)	100						93,046	98,338
Casting copper	99						2,933	3,339
Copper sheet, rod, tubing, etc	99						540	8,037
Copper powder	98						[1] 2,857	2,727
Copper castings	98						2,759	415
Total unalloyed copper products							102,135	112,856
Brass and bronze ingots:								
Tin bronze	88	10		2			53,552	41,621
Leaded-tin bronze	88	6	1.5	4.5			108,336	37,963
Leaded red brass	85	5	5	5			123,686	128,326
Leaded semired brass	81	3	7	9			48,316	36,162
High-leaded-tin bronze	80	10	10				29,918	39,326
Do	84	6	8	2			24,473	7,221
Do	75	5	20				(2)	4,466
Leaded yellow brass	66	1	3	30			25,843	19,269
Manganese bronze	62			27		5	72,677	41,495
Aluminum bronze	89					10	5,517	3,439
Nickel silver	58	2	7	18	14		3,394	3,704
Do	65	4	3	5	22			
Low brass	80			20			(3)	4,677
Silicon bronze	92			4			5,096	3,060
Conductor bronze	94	2	2	2			(4)	438
Hardeners and special alloys	81						17,453	7,287
Total copper-alloy ingots							518,261	378,454
Brass mill billets made by ingot makers							33,180	16,653
Brass and bronze sheet, rod, tubing, etc							[5] 509,153	[5] 576,115
Brass and bronze castings							[6] 143,665	[6] 142,532
Brass powder							883	659
Copper in chemical products (content)							13,357	18,666

[1] Corrected figure.
[2] Production of this item combined with 80-10-10 group in 1944.
[3] Production of this item combined with leaded yellow brass in 1944.
[4] Production of this item combined with 85-5-5-5 group in 1944.
[5] Gross weight of secondary brass and bronze in commercial shapes. Includes 347,429 tons of copper, 275 tons of nickel, 4,210 tons of lead, 330 tons of tin, 156,830 tons of zinc, and 79 tons of aluminum in 1944; and 398,822 tons of copper, 937 tons of nickel, 4,938 tons of lead, 837 tons of tin, 170,099 tons of zinc, and 482 tons of aluminum in 1945.
[6] Gross weight of secondary brass and bronze castings. Includes 118,391 tons of copper, 29 tons of nickel, 9,987 tons of lead, 7,493 tons of tin, and 7,765 tons of zinc in 1944; and 112,768 tons of copper, 158 tons of nickel, 12,917 tons of lead, 8,138 tons of tin, 8,517 tons of zinc, and 34 tons of aluminum in 1945.

Total production of brass-mill products from copper and copper-base scrap showed a 15-percent increase over the 1944 level. The tonnage of unalloyed copper products reported recovered from scrap rose from 540 tons in 1944 to 8,037 tons in 1945 and of brass and bronze sheet, rod, and tubing from 509,153 tons in 1944 to 576,115 tons in the following year. Military requirements for brass strip, which had been at a war peak at the beginning of the year, declined steadily until June, when those plants operated under contracts of the Defense Plant Corporation were closed because of reduced demand. During the latter part of the year brass mills swung easily into civilian production but were hampered at the year end by labor difficulties. The CPA estimated that total 1945 production of brass-mill products was approximately 27 percent less than that in 1944, which would indicate that a larger proportion of these products was made from scrap in 1945 than in the preceding year. In this connection, it should be noted that the 1945 statistics of production from secondary sources include figures covering the reduction of fired-cartridge cases to slabs under the stock-piling program.

As outlined by the Readjustment Division of the Army Service Forces in July, the original plan was to stock-pile cartridge brass, gilding metal, and leaded rod brass, to be obtained from salvage, termination inventories, and final production scrap originating in the war program. The metal was to be melted down into slabs if it met specifications, the idea being to allot this material to consumers gradually so that it would be replaced in Metals Reserve Company stock piles by refined copper and zinc. For some weeks, cartridge cases were offered to the trade at ceiling prices, and if they remained unsold they were melted into slab and stored. Then it was announced that the Treasury was unwilling to provide the funds for purchasing the cartridge cases for stock piling, and the Surplus Property Administration ordered them sold to the highest bidder under sealed bids. This was found to be contrary to the Surplus Property Act of 1944; and at a conference held by the representatives of the Army Service Forces, the Surplus Property Administration, and the Treasury Department, it was decided to stock-pile all clean brass cartridge cases. By the end of the year, the scarcity of scrap made another reversal of policy necessary, and the Army Service Forces once again offered cartridge cases for sale at ceiling prices instead of stock-piling them.

Brass and bronze foundries reported the recovery of 142,532 tons of secondary brass and bronze in castings during 1945—a slight decrease from the 143,665 tons of castings produced from scrap in 1944. As in the past, a large part of this tonnage consisted of bronze railroad bearings remelted in railroad foundries and in plants of bearing companies on a toll basis.

Consumption of purchased copper scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries				Total scrap used
			Brass mills		Foundries and other manufacturers		
	New scrap	Old scrap	New scrap	Old scrap	New scrap	Old scrap	
No. 1 wire and heavy	20,809	46,387	7,271	2,612	2,007	15,756	94,842
No. 2 wire, mixed heavy, and light	14,889	54,925	10,969	2,534	3,297	7,338	93,952
Composition or red brass	43,828	52,716			22,165	26,931	145,640
Railroad-car boxes		939				51,424	52,363
Yellow brass	37,674	93,024	323,473	127,844	4,408	8,429	594,852
Cartridge cases	278	21,522		82,350		132	104,282
Auto radiators (unsweated)		16,694				85	16,779
Electrotype shells		1,306				1	1,307
Bronze	9,745	25,842	105	2,932	1,391	7,064	47,079
Nickel silver	668	2,151	3,867	1,192	160	12	8,050
Low brass	14,345	166	17,887	12,947	175	5,798	51,318
Aluminum bronze	115	592	6	372	86	122	1,293
High-lead brass						1,692	1,692
Low-grade scrap and residues	189,648	66,701			802	137	257,288
	331,999	382,965	363,578	232,783	34,491	124,921	1,470,737

Consumption of purchased copper and brass scrap in 1945 totaled 1,470,737 short tons, gross weight, compared with 1,407,860 tons used in 1944. Use of scrap at plants of brass-ingot makers and refineries declined 2 percent to 714,964 tons and in brass and bronze foundries 5 percent to 159,412 tons. However, brass mills increased their consumption of scrap from 511,661 tons in 1944 to 596,361 tons in 1945—a gain of 17 percent. The remelting of fired cartridge cases declined from 136,448 tons in 1944 to 104,282 tons in 1945, marking the first decline in use of this item in 4 years. War Department reports on sales of fired cartridge cases indicated the use of a slightly larger tonnage, and this classification may have been combined with another item of scrap by some reporting companies.

During 1944 and 1945, the War Department operated on a policy of expediency in the matter of returning both ferrous and nonferrous scrap from overseas. Items of scrap that could be readily identified and transported were returned to the United States for reuse; however, in the fall of 1945 a committee of experts on ferrous and nonferrous scrap was sent to Europe by the Army Service Forces to survey the quantity of material on hand and to recommend a plan for its disposal. War Department policy evolved from this survey, regarding the disposition of nonferrous scrap, is stated as follows:

> Tin-bearing scrap and lead scrap will be returned after clearance with the Civilian Production Administration. Copper and brass scrap will be returned to the United States except from the United Kingdom, France, Belgium, and the Netherlands. All aluminum scrap, except landing mat, will be disposed of locally. Aluminum landing mat will be returned because of its high metal content. All other nonferrous scrap will be disposed of locally.

Sales of nonferrous scrap by the War Department from both overseas and domestic sources during the year were as follows: Cartridge cases, 127,640 short tons; other copper and brass scrap, 110,789 tons; aluminum scrap, 84,653 tons; and all other nonferrous scrap, 33,487 tons.

During the first part of the year the supply of and demand for copper-base scrap were sufficiently in balance to provide full production of materials to keep prices at ceiling levels. After the end of the war, reconversion of manufacturing plants and curtailment of production due to labor troubles decreased the generation of scrap and therefore its consumption. The copper-scrap situation at the end of the year was one of strong demand for most types and marked scarcity of some items, including those in OPA group 2 and brass mill scrap.

Consumers' stocks of purchased copper-base scrap in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1944 [1]	Dec. 31, 1945
Unalloyed copper	10,660	16,307
Copper-base alloy	53,456	58,658
Low-grade scrap and residues	39,686	45,620
	103,802	120,585

[1] Revised figures.

Inventories of copper and brass scrap at consumers' plants increased 16 percent from 103,802 tons (revised figure) at the beginning of the year to 120,585 tons on December 31, 1945.

Dealers shipped 490,789 tons of copper and brass scrap to consumers during 1945, or 2 percent less than the 501,493 tons shipped during the preceding year. A noticeable decline in shipments of copper and brass scrap was evident during the latter half of the year; however, an all-time high was reached in March 1945, when 50,413 tons were moved. Stocks held by dealers at the end of the year totaled 70,604 tons, the largest inventory on record and an increase of 36 percent over the 51,726 tons held on December 31, 1944.

There were no changes in ceiling prices on brass and bronze ingot during the year, the last revision in OPA Maximum Price Regulation 202 having been made on April 1, 1944. After that date the prices on the principal grades of ingot were as follows: 85–5–5–5, 13.00 cents a pound; 80–10–10, 15.75 cents; yellow brass, 10 cents; and 88–10–2, 16.50 cents. Maximum prices for copper and brass scrap were regulated under revised Maximum Price Regulation 20, on which two amendments were issued during the year. Under amendment 3 to the regulation, issued on March 3, 1945, written agreements between railroad companies and bearing companies for the conversion of railroad scrap were no longer required to be approved by the WPB. Amendment 4, effective August 6, 1945, allowed a special use premium of 1¼ cents a pound for copper-alloy scrap when the scrap was prepared to meet the specifications of certain qualified consumers. A similar premium had been provided in the past for unalloyed copper scrap. Ceiling prices for the basic copper-scrap items were unchanged, with No. 1 wire and heavy copper at 9.75 cents a pound, No. 2 wire and mixed heavy copper at 8.75 cents a pound, and No. 1 composition at 9.00 cents a pound f. o. b.

Scrap generated from the fabrication of brass stock produced by brass mills was designated as "brass-mill scrap," and maximum prices were first established on June 18, 1941, under Maximum Price Regulation 12. In 1944 and 1945 this regulation covered 32 different grades of scrap, with a separate price within each class for clean heavy scrap, rod ends, and clean turnings.

The average dealers' buying price for No. 1 copper scrap at New York opened at 9.37 cents a pound. This price was maintained until November, when it dropped to 9.12 cents and remained there for the rest of the year, resulting in an average price of 9.33 cents. The average price of No. 1 composition scrap for 1945 was 8.83 cents a pound, 0.04 cent below the average for 1944.

The early part of the year brought a tightening of WPB controls on copper under Orders M–9 and M–9–c; but, as the end of the war came closer, controls began to be lifted. Order M–9–c and its related orders, which restricted the manufacture, delivery, and installation of many copper products, were revoked on May 12. Several changes were made in Order M–9 in June, easing the restrictions on copper raw materials. Finally this order was revoked by the WPB on August 20 and the Controlled Materials Plan on September 30, so that the only control of copper materials remaining in effect was the 30-day inventory limitation on copper and copper-base alloys. Later in the year the OPA revoked section 9 of RMPR 20, no longer requiring the reporting of settlements for copper-base scrap.

Brass and copper scrap imported into and exported from the United States, 1944–45, in short tons

	1944	1945
Brass scrap imported	6,226	7,727
Scrap copper imported	1,055	1,348
Brass scrap exported	38	421
Scrap copper exported	99	133

SECONDARY NICKEL

Secondary nickel recovered from nonferrous scrap in 1945 totaled 6,483 short tons valued at $4,538,100, a 50-percent gain over the 4,321 tons valued at $3,024,700 in 1944. The total value was calculated for both years at 35.0 cents a pound, the spot-delivery price of electrolytic nickel. The principal reason for this large increase in recovery of secondary nickel lies in the fact that improvements in the metallurgy of secondary aluminum ingot and in reporting procedure have made it possible, for the first time, to reckon definite recovery of secondary nickel from the melting of certain items of aluminum-base scrap.

Secondary nickel (nonferrous) recovered in the United States, 1944–45, in short tons

Secondary nickel recovered			Recoverable nickel content of scrap		
Form of recovery	1944	1945	Kind of scrap processed	1944	1945
As metal	392	31	New scrap:		
In nickel-base alloys	1,128	672	Nickel-base	1,693	2,203
In copper-base alloys	1,866	2,120	Copper-base	430	821
In cast iron and steel [1]	525	1,702	Aluminum-base		1,227
In chemical compounds	410	594		2,123	4,251
In aluminum-base alloys		1,364			
	4,321	6,483	Old scrap:		
			Nickel-base	1,522	1,449
			Copper-base	676	643
			Aluminum-base		136
			Lead-base		4
				2,198	2,232
				4,321	6,483

[1] Includes only nonferrous nickel scrap added to cast iron and steel.

The total recovery of nickel as metal fell from 392 tons in 1944 to 31 tons in 1945, and the production of secondary monel-metal pig, shot, and castings dropped from 1,100 tons in 1944 to 450 tons in 1945. The production of copper-nickel pig and shot declined from 776 tons averaging 49 percent nickel in 1944 to 670 tons averaging 51 percent nickel in 1945. The year marked a definite swing in the use of nickel-base scrap, as comparatively insignificant tonnages of this material were used in the production of nickel as metal or in nickel-base alloys, whereas a much larger quantity of nickel in monel scrap than ever before was reported used by steel plants and gray-iron foundries for alloying purposes in cast iron and steel products. Consumption of all types of nickel scrap increased over that in the previous year, the most important single factor being the gain in use of nickel-silver scrap, particularly in brass mills and foundries. Total stocks of 4,350 tons of nickel scrap at consumers' plants on December 31, 1945, were more than double the 2,045 tons on hand December 31, 1944. Stocks of nickel scrap in scrap-metal dealers' yards increased from 1,994 tons to 2,114 tons in the same period.

Consumption of purchased nickel scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Pure nickel	89	58	394	388	929
Monel metal	705	888	1,617	579	3,789
Nickel silver	668	2,151	4,027	1,204	8,050
Miscellaneous nickel alloys	2				2
Nickel residues	127		172	313	612
	1,591	3,097	6,210	2,484	13,382

Nickel remained under allocation and under restrictive orders governing its use during the first half of 1945, but as the end of the war approached the WPB moved swiftly to end control. On July 19, Conservation Order M–6–b and Direction 1 to that order, which controlled the end uses of nickel and nickel solutions respectively, were revoked. Order M–6–a, which governed the allocation of nickel, remained in effect until August 16, when it also was revoked. Thereafter only general regulation of nickel was exercised under General Preference Order M–21, which controls the production of alloy steel and alloying materials used in steel production.

Maximum prices on all types of ferrous and nonferrous nickel scrap, secondary monel ingot and shot, and secondary copper-nickel shot were lifted under OPA Suspension Order 129, effective August 31, 1945. Up until that date the maximum price for nickel scrap had remained unchanged, having been set at 26 cents a pound for pure nickel scrap and 20 cents a pound for new monel clippings on June 2, 1941. Dealers' buying prices for nickel scrap in New York were quoted at 18.50 cents a pound and for monel clips at 12.50 cents a pound throughout the entire year. These prices are comparable with the average quotation of 19.50 for nickel clips and 15 cents for monel clips in 1944.

No imports of nickel-bearing scrap were reported in 1944 or 1945, but exports in 1945 totaled 2,287 short tons compared with 4,021 tons in 1944.

Consumers' stocks of purchased nonferrous nickel scrap [1] in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand— Dec. 31, 1944	On hand— Dec. 31, 1945
Unalloyed nickel	161	937
Nonferrous nickel alloys	1,339	2,375
Nickel residues	545	1,038
	2,045	4,350

[1] Includes nickel-silver scrap.

SECONDARY LEAD

The secondary lead industry continued operations at a high level in 1945, with 363,039 short tons of lead valued at $46,468,992 recovered from scrap, compared with 331,416 tons valued at $42,421,248 recovered in 1944. Values were computed for both years at 6.4 cents a pound, the average selling price of all grades of primary lead exclusive of premium price payments. This increase in production from secondary sources did much to offset the declining domestic production and dwindling imports of primary lead. Production of soft lead from scrap rose 15 percent—from 61,700 tons in 1944 to 70,951 tons in 1945—and the secondary lead content of antimonial lead produced rose 7 percent—from 180,818 tons in 1944 to 194,079 tons in 1945. Secondary lead recovered in solder declined from 22,245 tons in 1944 to 19,964 tons in 1945, whereas the secondary lead content of type metals produced showed a substantial increase for the first time in several years—28,525 tons in 1945, compared with 23,870 tons in 1944 and 23,201 tons in 1943. Data furnished by responding companies revealed that the primary-metal content of secondary lead products increased slightly, but total production of the secondary lead industry showed a substantial gain during the year.

Secondary lead recovered in the United States, 1944–45, in short tons

Secondary lead recovered: Form of recovery	1944	1945	Recoverable lead content of scrap: Kind of scrap processed	1944	1945
As metal:			New scrap:		
At primary plants	11,368	18,525	Lead-base	33,127	44,793
At other plants	43,678	42,598	Copper-base	8,356	7,417
	55,046	61,123		41,483	52,210
In antimonial lead [1]	180,818	194,079	Old scrap:		
In other lead alloys	68,271	77,051	Battery-lead plates	164,106	186,241
In copper-base alloys	26,667	30,346	All other lead-base	113,145	107,351
In tin-base alloys	614	440	Copper-base	12,640	17,198
			Tin-base	42	39
	276,370	301,916		289,933	310,829
	331,416	363,039		331,416	363,039

[1] Includes 34,475 tons of lead recovered in antimonial lead from secondary sources at primary plants in 1944 and 42,366 tons in 1945.

Shipments[1] of secondary lead, tin, and lead- and tin-alloy products in the United States in 1945, gross weight, in short tons

	Gross weight of product[2]	Secondary metal content			
		Lead	Tin	Antimony	Copper
Refined pig lead	51,507	51,507	-	-	-
Remelt lead	19,444	9,616	-	-	-
Lead foil	-	-	-	-	-
	70,951	61,123	-	-	-
Refined pig tin	3,622	-	3,622	-	-
Remelt tin	148	-	82	-	-
Tin foil	13	-	13	-	-
	3,783	-	3,717	-	-
Lead and tin alloys:					
Antimonial lead	255,613	194,079	356	10,798	-
Common babbitt	37,286	24,986	1,533	2,467	25
Genuine babbitt	4,252	76	1,418	163	95
Other tin babbitts	886	364	174	50	9
Solder	55,985	19,964	7,740	238	6
Type metals	37,393	28,525	2,014	2,925	14
Miscellaneous lead-tin alloys	11,775	2,435	38	65	-
	403,190	270,429	13,273	16,706	149
Composition foil	1,903	1,141	49	17	-
Tin content of chemical products	465	-	465	-	-

[1] This table has been titled incorrectly in previous chapters of the Minerals Yearbook. Most of the figures herein represent shipments rather than production of the items involved. However, it has been necessary to record actual production figures in some instances where the information is secured from reports on that basis.
[2] Difference between gross weight of product and secondary metal content represents added primary metals or impurity content.

Of the total secondary lead recovered, 338,424 short tons were reclaimed from lead- and tin-base scrap; the remaining 24,615 tons were contained in secondary brass and bronze and reclaimed by remelting copper-base scrap. A total of 5,731 tons of lead in lead-base scrap was added to brass and bronze to bring the total recovery of secondary lead in this type of product to 30,346 tons.

Consumption of purchased lead scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Soft lead	-	44,749	10	1,799	46,558
Hard lead	-	19,320	1	2,137	21,458
Cable lead	-	9,303	12	26	9,341
Battery-lead plates	-	279,454	-	17	279,471
Mixed common babbitt	-	5,791	55	12,382	18,228
Solder and tinny lead	-	7,793	-	2,096	9,889
Type metals	-	15,143	-	45	15,188
Dross and residues	72,362	-	-	-	72,362
	72,362	381,553	78	18,502	472,495

Consumption of lead-base scrap totaled 472,495 short tons, gross weight, in 1945, compared with 429,261 tons used in 1944. The use of battery-lead plates rose 33,213 tons, of drosses and residues 8,786 tons, of hard-lead scrap 4,556 tons, of cable-lead scrap 1,067 tons, and of type-metal scrap 532 tons; but consumption of solder and tinny-lead scrap declined 2,543 tons, of soft lead 2,051 tons, and of mixed common babbitt scrap 326 tons. The best index of activity at plants of secondary lead smelters and remelters is their consumption of scrap each month. Consumption of all lead-base items reached a low point for the year in February and gained until May, after which it declined sharply to another low point in August at the end of the war, then climbed sharply to the year's peak in October.

Throughout 1945 the demand for lead considerably exceeded supply, necessitating a constant drain on stock piles of the metal held by Office of Metals Reserve (successor to Metals Reserve Company, July 1). This critical situation was attributable to the manpower shortage throughout both the primary and secondary branches of the industry. Plant capacity was adequate in all instances, but the labor problem could not be overcome. Early in January, WPB officials met with lead producers in an effort to increase secondary output. As a result, secondary lead production was placed on the national production urgency list, in order to assist the War Manpower Commission in determining manpower priority ratings. Another boost in secondary lead production was brought about by a program effected through the assistance of Metals Reserve Company, for converting low-grade lead byproducts to usable metal. Much of this idle material in the hands of dealers and secondary smelters was shipped to plants equipped to handle it, and the Government paid a subsidy in the form of transportation costs.

Percentage metals circulated in pig form among remelters and smelters in 1945 totaled 58,693 short tons, consisting of 37,003 tons of antimonial lead, 7,750 tons of lead babbitt, 6,812 tons of soft lead, 4,551 tons of solder, 1,724 tons of type metal, 695 tons of tin babbitt, 92 tons of remelt tin, 61 tons of cable lead, and 5 tons of pewter.

Consumers' inventories of lead scrap rose from 71,598 tons on hand December 31, 1944, to 79,974 tons at the end of 1945. Stocks of both soft-lead scrap and the lead-base alloys increased, whereas inventories of drosses and residues declined, probably as a result of the campaign for the reduction of this material. During the same period stocks of secondary pig, bar, and ingot metals at these plants increased from 17,709 short tons to 28,982 tons.

Consumers' stocks of purchased lead-base scrap in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1944	Dec. 31, 1945
Unalloyed lead	2,457	3,624
Lead-base alloy	35,785	49,162
Drosses and residues	33,356	27,188
	71,598	79,974

Scrap-metal dealers' stocks of lead-base scrap declined from 38,906 tons on December 31, 1944, to 36,734 tons on December 31, 1945, but shipments of lead scrap from dealers to consumers totaled 304,825 tons in 1945, compared with 283,165 tons in the preceding year. Movement of scrap through dealer channels was particularly slow during January and February because of severe snowstorms in the North and East, but activity was brisk thereafter, reaching a peak in October, after which it experienced another seasonal decline at the end of the year.

The maximum prices for lead scrap were continued unchanged throughout 1945. The price schedule outlined the formula for the maximum prices of heavy lead scrap as follows: Primary pig lead at New York was fixed at 6.50 cents a pound, and the price of heavy lead scrap was 0.55 cent less, or 5.95 cents a pound. Considerable agitation for a free market in lead developed toward the end of the year, but the ceiling on primary lead was kept at 6.5 cents a pound, despite a somewhat higher average over-all production cost, and the difference was paid to producers under the Premium Price Plan.

Dealers' buying prices for heavy lead scrap remained unchanged for the third consecutive year at 5.37 cents a pound, the monthly average quotation at New York being constant since August 1942. Dealers' buying prices for battery-lead plates averaged 2.927 cents a pound for the year, being quoted at 2.75 cents until the middle of April, then at 3 cents for the rest of the year. Battery-plate smelting charges, which determined the dealers' net selling price, were seldom quoted, toll agreements for smelting scrap being prohibited except on authorization by the OPA.

As in 1944, both scrap and secondary lead were subject to allocation by the WPB, but free movement of these materials was encouraged as much as possible. The only lead allocated was that released by the Metals Reserve Company, the greater portion of which was imported. Efforts of the Lead-Tin-Zinc Branch of the WPB were laregly devoted to constant check of inventories and turn-over, in order to insure equitable distribution and prevent hoarding. General Preference Order M–38 was amended several times during the year, sometimes raising, sometimes lowering the quota of lead permissible for certain industrial uses. In August, Order M–72 controlling the flow of lead and tin scrap was revoked, but on October 24 Direction 5 to Priorities Regulation 32 was issued, making continued reporting mandatory for all dealers with a 20-ton inventory of lead and tin scrap. This direction also prohibited dealers from receiving lead and tin scrap unless they had disposed of an amount at least equal to their current inventory during the preceding 60 days. In view of the continued shortage of these metals and agitation for increased prices, this action was deemed necessary in order to prevent accumulation of excess stocks. On December 19, the CPA issued an amendment to Order M–38, to become effective January 1, 1946, prohibiting the use of primary metal when secondary was obtainable and usable for the purpose.

Imports of lead scrap from other countries declined from 3,315 tons (revised figure; lead content) in 1944 to 2,844 tons (lead content) in 1945.

SECONDARY TIN

Secondary tin recovered from scrap totaled 35,133 short tons valued at $36,538,320 in 1945, compared with 32,589 tons valued at $33,892,560 recovered in 1944. The value was computed at 52 cents a pound in both years.

Detinning plants produced 3,527 short tons of pig tin from new tinplate clippings and old tin cans, and 13 tons of tinfoil and 177 tons of tin as metal in other forms were recovered at various plants from tin-base scrap and residues. The total recovery of unalloyed tin from scrap was 3,717 tons, a decline of approximately 12 percent from the 4,245 tons recovered in 1944. Although the recovery of tin in tin-base babbitts declined from the 1944 figure, recovery in solder, in chemical compounds, in lead-base alloys, and in brass and bronze all increased.

Secondary tin recovered in the United States, 1944–45, in short tons

Secondary tin recovered: Form of recovery	1944	1945
As metal:		
At detinning plants	3,751	3,527
At other plants	494	190
	4,245	3,717
In solder	4,892	7,740
In tin babbitt	2,448	1,592
In chemical compounds	[1] 463	465
In lead-base alloys	3,301	3,990
In brass and bronze	[1] 17,240	17,629
	28,344	31,416
	32,589	35,133

Recoverable tin content of scrap: Kind of scrap processed	1944	1945
New scrap:		
Tin plate	2,654	2,911
Tin-base	2,002	1,772
Lead-base	732	1,360
Copper-base	5,852	5,113
	11,240	11,156
Old scrap:		
Tin cans	1,447	1,070
Tin-base	4,487	4,392
Lead-base	5,684	5,156
Copper-base	9,731	13,359
	21,349	23,977
	32,589	35,133

[1] Revised figures.

The flow of all types of tin-base scrap except the pure tin item, block-tin pipe, declined slightly from the 1944 level, reflecting the growing scarcity of tin in the United States. The increase in use of block-tin-pipe scrap was probably due to more intensive salvage efforts, bringing material into circulation which would not normally have been reclaimed. The National Lead Co.'s program for recovering tin from excess type metal accounted for 11 tons of tin in 1945 compared with 113 tons (revised figure) in 1944. This material was recovered as a tin-bearing chemical residue and later reduced to metallic tin at one of the detinning plants.

The Government-owned stock pile of tin, which had amounted to 83,076 tons of tin on January 1, 1942, was down to 23,350 tons on December 31, 1945, precluding any possibility of relaxation of controls even after hostilities ended. Tin-bearing scrap was scarce, and demand constantly exceeded supply, so that ceiling prices prevailed throughout the year. CPA officials feared that reconversion would cause demands for the metal that could not possibly be satisfied and that delay in reconversion to civilian production might result, particularly in the automotive industry.

Consumption of purchased tin scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Block-tin pipe, scrap, and foil		665		158	823
Tin scruff and dross	2,863		2		2,865
No. 1 pewter		101		2	103
High-tin babbitt		4,135		37	4,172
Residues	118				118
	2,981	4,901	2	197	8,081

Because of the dwindling stock pile and the constant demand for tin, the WPB issued several orders tightening controls during the year. In December, however, its successor agency, the CPA, eased controls slightly. An amendment to General Preference Order M–43 on March 8 prohibited the use of tin in the manufacture of automobile solder and the use of solder containing tin in the repair of automobile bodies and fenders. This amendment also provided that users of fabricated bearings containing more than 12 percent tin must furnish the manufacturer with a "use certificate." On May 31 Order M–43 was again amended, establishing the corresponding quarter of 1944 (instead of 1940) as the base period for allocations. On December 17 the order was revised further to permit freer use of tin in some products. One of these changes specified that solder containing no more than 4 percent of secondary tin could be used for automobile solder.

Consumers' stocks of purchased tin-base scrap in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand—	
	Dec. 31, 1944	Dec. 31, 1945
Unalloyed tin	81	69
Tin-base alloys	481	191
Drosses and residues	784	762
	1,346	1,022

Dealers' buying prices on block-tin-pipe scrap at New York were quoted at 45.5 cents a pound throughout the year, this being the fourth successive year that the price had held at that figure. Total shipments of 1,167 tons of tin babbitt and pewter and 209 tons of block-tin pipe to consumers were reported by scrap-metal dealers during 1945, indicating that most shipments of tin scrap went directly to consumers from industrial sources. Imports of tin dross amounted to only 57 long tons in 1945 and 48 tons in 1944, compared with exports of tin scrap and waste of 3,453 and 3,157 tons in the same 2 years.

Detinning plants.—A total of nine detinning plants reported operations in 1945: Johnston & Jennings Co., Metal & Thermit Corp. (three plants), Standard Metal Refining Co., Vulcan Detinning Co. (two plants), Southern Detinning Co., and the Compressed Steel Co.

at Denver, Colo. The last plant operated for only a short time and discontinued treatment of tin plate before the end of the year. These plants had a much greater capacity for handling tin-plate clippings and used cans than was needed during 1945, because the supply of material for processing continued the decline begun in 1944.

Secondary tin recovered at detinning plants in the United States, 1944–45

	1944	1945
Scrap treated:		
Clean tin plate……long tons	227,220	257,545
Old tin-coated containers……do	146,976	114,311
	374,196	371,856
Tin recovered from new tin-plate clippings……short tons	2,654	2,911
Tin recovered from old tin-coated containers……do	1,447	1,070
	4,101	3,981
Tin recovered as metal……short tons	[1] 3,751	[1] 3,527
Tin recovered in compounds……do	[2] 350	[2] 454
	4,101	3,981
Weight of tin compounds produced……short tons	774	933
Average quantity of tin recovered per long ton of clean tin-plate scrap used……pounds	23.36	22.61
Average quantity of tin recovered per long ton of old tin-coated containers used……pounds	19.68	18.73
Average delivered cost of clean tin-plate scrap……per long ton	$14.72	$14.18
Average delivered cost of old tin-coated containers……do	$14.12	$14.09

[1] Includes a small tonnage of pig tin averaging less than 95 percent tin content and, consequently, subject to further refining or alloying.

[2] Represents the total recovery of tin in compounds reported by the detinners as an industry. Some of this material was reduced to metallic tin at the Texas City tin smelter, and some was sold for use in the form produced. In calculating total domestic tin production, only the tin recovered as metal at detinning plants should be used.

On four occasions during 1945 the WPB issued amendments and directions to Conservation Order M–325, striving to increase the tonnage of used cans and tin-plate clippings being shipped to detinners. None of these measures was effective in increasing the flow of old cans, however, because they failed to reach the housewives who were responsible for saving and preparing them. In general, those homemakers who were still preparing cans for collection stopped doing so after the end of hostilities, and collection systems in the major cities broke down almost immediately. Only 28,223 long tons of prepared cans were sold by the War Department to detinners in 1945, compared with 40,000 tons in 1944, reflecting the decline of personnel in camps in the United States.

The average quantity of tin recovered per long ton of scrap treated continued its downward trend in 1945, showing the effect of substitution of electroplating for hot dipping of tin plate and the use of lacquered or "bonderized" metal instead of tin plate in many cans. The average recovery of tin from new clippings was 22.61 pounds per long ton in 1945, compared with 23.36 pounds in 1944, and the average recovery from old cans was 18.73 pounds per long ton in 1945, compared with 19.68 pounds in 1944.

Imports of tin-plate scrap increased from 17,323 long tons in 1944 to 18,072 tons in 1945. Exports of tin-plate scrap, circles, wastewaste, and clippings rose from 4,670 long tons (revised figure) in 1944 to 14,710 tons in 1945.

SECONDARY ANTIMONY

Recovery of secondary antimony in lead-base and tin-base alloys totaled 17,148 short tons valued at $5,432,487 in 1945, an 8-percent increase over the 15,886 tons valued at $5,032,685 recovered in 1944. The value was computed in both 1945 and 1944 at 15.84 cents a pound—the average selling price for ordinary American-brand antimony in the 2 years at New York.

Secondary antimony recovered in the United States, 1944–45, in short tons

Secondary antimony recovered			Recoverable antimony content of scrap		
Form of recovery	1944	1945	Kind of scrap processed	1944	1945
In antimonial lead	10,894	11,223	New scrap:		
In other lead alloys	4,643	5,712	Lead-base	327	2,097
In tin-base alloys	349	213	Tin-base	1	----------
	15,886	17,148		328	2,097
			Old scrap:		
			Lead-base	15,255	14,766
			Tin-base	303	285
				15,558	15,051
				15,886	17,148

As in former years, the principal source of antimony recovered from scrap in 1945 was old battery plates. Due to the efforts of the WPB and its successsor agency, the CPA, in channeling all types of lead- and tin-base scrap back to smelters' plants for reconversion, the tonnage of battery plates treated increased from 246,258 tons in 1944 to 279,471 tons in 1945. This resulted in a recovery of 8,804 tons of antimony from this source during the year, an increase of 13 percent over the 7,757 tons of antimony reclaimed in 1944. The quantity of antimony recovered in antimonial lead and in other lead-base alloys increased over that in 1944, but recovery of antimony in tin-base alloys declined. Remelters, smelters, and refiners recovered 90 percent of the antimony reclaimed in 1945, the other 10 percent being recovered by bearing manufacturers and other foundries. Consumption of purchased scrap from which antimony was recovered may be found in the tables on consumption of lead-base and tin-base scrap in the sections of this chapter devoted to those metals. Products in which antimony was recovered are included in the lead- and tin-products table.

As in the past, all antimony recovered from scrap remained in the alloyed state, none being regained as unalloyed metal or in chemical compounds as far as could be determined. It should be noted also that the antimony content of antimonial lead scrap makes it desirable to process this material back to antimonial lead, even when processed in primary lead plants. Reports from prinary lead plants on the annual survey have established the fact that very little antimonial lead scrap actually goes into refined lead at these plants. In the instances where this does occur, the antimony skimmings collected in the lead refining process are retained until a large enough quantity accumulates to justify making a run of antimonial lead.

Early in 1945 the critical shortage of antimony made it necessary for the WPB to assume full control of deliveries and use of the metal, by amending General Preference Order M–112, effective February 10. This amendment stipulated that no one might receive, in any one current month, more than 224 pounds of antimony (compared to 2,240 pounds permitted previously), except by allocation. The amendment of February 10 also limited inventories of antimony ore to a 45-day supply and other forms of antimony to a 30-day supply. Manufacturers were having difficulty in procuring the metal which had been allocated to them, even for war purposes. The demand for all types of antimony exceeded domestic production by a wide margin. On May 12 Order M–112 was again amended, requiring purchasers of over 224 pounds of antimony to certify their needs to the WPB. In October, an amendment to General Preference Order M–38 was issued, restricting the antimony content of storage-battery plates for general use to 9 percent.

There was no change in the ceiling prices for antimony in alloy metals or metallic scrap during 1945, the price having remained at 15.50 cents a pound of contained antimony since April 1942. There was no regulation of prices for antimony in drosses or other residues. The maximum price for standard-grade antimony remained 14.50 cents a pound at Laredo, Tex.

SECONDARY ZINC

Secondary zinc recovered in 1945 from purchased scrap and residues totaled 360,444 short tons with a value of $61,996,368, calculated at 8.6 cents a pound, the average selling price for the year of all grades of refined zinc, not including bonuses paid by Metals Reserve Company under the Premium Price Plan. This total was 4 percent higher than in 1944, when 345,469 tons with a value of $59,420,668 at 8.6 cents a pound were recovered.

Secondary zinc recovered [1] in the United States, 1944–45, in short tons

Secondary zinc recovered		
Form of recovery	1944	1945
As metal:		
By distillation:		
Slab zinc	48,582	48,816
Zinc dust	22,753	23,416
By remelting	8,178	11,704
	79,513	83,936
In zinc-base alloys	6,826	6,531
In brass and bronze	222,383	226,756
In aluminum-base alloys	9	1,355
In chemical products:		
Zinc oxide (lead free)	7,076	9,130
Zinc sulfate	2,558	3,216
Zinc chloride	11,117	11,666
Lithopone	13,720	15,647
Miscellaneous	2,267	2,207
	265,956	276,508
	345,469	360,444

Recoverable zinc content of scrap		
Kind of scrap processed	1944	1945
New scrap:		
Zinc-base	106,504	118,277
Copper-base	125,765	119,343
Aluminum-base	39	1,227
	232,308	238,847
Old scrap:		
Zinc-base	26,018	21,158
Copper-base	87,143	100,338
Aluminum-base		101
	113,161	121,597
	345,469	360,444

[1] Zinc content.

The recoverable zinc content of zinc-base scrap consumed in 1945 increased 5 percent and that of the copper-base scrap consumed 3 percent. Zinc is salvaged from zinc-base scrap chiefly by distillers, remelters, and chemical plants in the form of zinc-base products but is recovered from brass scrap largely by brass-ingot makers, brass mills, and foundries and emerges for reuse in copper and brass. In 1945 only 3,238 tons of zinc were recovered in brass from zinc scrap. It may be said of secondary copper, aluminum, and lead that each is recovered mostly from scrap of which it is the chief constituent, but more zinc is reclaimed from brass scrap than from zinc-base scrap. In the years after the war galvanizing can be expected to increase, so that the generation and, consequently, the consumption of zinc-base scrap will increase. In 1945, 219,681 tons or 61 percent of the total secondary zinc recovered came from copper-base scrap, nearly the same percentage as in 1944.

Secondary zinc recovered in 1945 increased in nearly all types of products, that reclaimed by remelting rising from 8,178 tons in 1944 to 11,704 tons in 1945, that recovered in zinc oxide from 7,076 tons to 9,130 tons, and that in lithopone from 13,720 tons to 15,647 tons. There was a small decrease in the recovery of zinc from scrap in zinc-base alloys, which included remelt die-cast slab and zinc-die alloys such as kirksite. Zinc recovered by remelting included remelt spelter, rolled zinc, cast zinc, and galvanizers' stock. Although the galvanizing industry is a major consumer of slab zinc, it does not use much scrap but generates galvanizers' dross, skimmings, and sal skimmings. Sal skimmings, which result when sal ammoniac flux is added to the molten zinc in the galvanizing kettle, have a zinc content of 40 to 50 percent and contain considerable zinc chloride. This item of scrap is used by chemical plants in the manufacture of zinc chloride and zinc ammonium chloride. If treated in a smelting furnace for recovery of zinc in metallic form, the zinc chloride must first be dissolved out or it will pass off in the flue gases and be lost.

Twenty-two distillers used zinc scrap in 1945, and of these 11 made only redistilled slab, 5 made only dust, and the other 6 made both. One plant that had produced slab in 1944 distilled no scrap in 1945; but all 1944 dust producers were still operating in 1945, and 1 new plant was added to the list covered by the survey.

Production of secondary zinc and zinc-alloy products in the United States, 1944–45, gross weight, in short tons

Product	1944	1945
Redistilled slab zinc	49,037	49,242
Zinc dust	[1] 23,307	23,892
Remelt spelter [2]	7,741	8,090
Remelt die-cast slab	3,760	4,727
Zinc-die and die-casting alloys	1,786	2,281
Galvanizing stock	594	701
Rolled zinc	1,737	3,054
Secondary zinc in chemical products	36,738	41,866

[1] Revised figure.
[2] Contains small tonnages of zinc anodes.

Secondary zinc recovered at 43 chemical plants in 1945 totaled 41,866 tons compared with 36,738 tons in the previous year. Secondary zinc recovery increased in all types of chemicals tabulated except the miscellaneous group, which includes leaded zinc oxide, zinc carbonate, and minor zinc chemicals.

In addition to the distillers and chemical plants, those covered by the survey included 117 remelters, brass-ingot makers, zinc smelters, and scrap-metal dealers and 81 foundries and other manufacturers.

Consumption of purchased zinc scrap in the United States in 1945, gross weight, in short tons

Scrap item	Remelters, smelters, and refiners		Manufacturers and foundries		Total scrap used
	New scrap	Old scrap	New scrap	Old scrap	
Clippings	4,597		4,995		9,592
Sheet and strip		4,774		499	5,273
Engravers' plates		1,670		88	1,758
Skimmings and ashes	45,044		28,531		73,575
Dross	52,997		598		53,595
Die castings	2,715	8,145	254	186	11,300
Rod and die scrap	1,492	4,477			5,969
Flue dust and residues	9,361	6,700	16,312	9,290	41,663
	116,206	25,766	50,690	10,063	202,725

Consumption of zinc-base scrap totaled 202,725 tons in 1945 compared with 199,000 tons in 1944. Of this, 168,833 tons (83 percent) were byproduct residues and the remainder metallic scrap. Of the residues, those resulting from galvanizing operations, galvanizers' dross, and skimmings showed the greatest increases in use for the year, that of the former rising from 48,613 tons in 1944 to 53,595 tons in 1945 and consumption of skimmings and ashes increasing from 64,902 tons in 1944 to 73,575 tons in 1945. A major use of galvanizers' dross is its distillation to make zinc dust, several plants in the country being devoted exclusively to this operation.

Of the metallic zinc items, consumption of die-cast and die scrap combined rose from 11,080 tons in 1944 to 17,269 tons in 1945. A factor in this rise was the increased salvage of obsolete and worn-out forming dies which had been used in the manufacture of aircraft. However, very little of the rod and die scrap was used in making new forming dies. Nearly all of it emerged as redistilled slab and zinc oxide.

Owing to the increased use of die-cast and rod and die scrap, metallic zinc-scrap consumption exhibited an erratic but generally rising trend during 1945. Total residue consumption decreased because, although galvanizing residue treatment increased, that of flue dust and chemical residues declined. The latter is a byproduct from the manufacture of sodium hydrosulfite.

Consumers' stocks of purchased zinc-base scrap in the United States at end of year, 1944–45, gross weight, in short tons

Scrap item	On hand— Dec. 31, 1944	On hand— Dec. 31, 1945
Metallic zinc scrap	2,222	10,903
Dross	7,475	6,605
Skimmings and residues	20,164	21,670
	29,861	39,178

Stocks of zinc scrap in the hands of consumers totaled 39,178 tons at the end of 1945, which compares with 29,861 tons at the end of the previous year. The rise was caused principally by increased inventories of die-cast and die scrap, which are included in the figure for consumers' stocks of metallic scrap.

Dealers supplied consumers with 56,491 tons of zinc scrap during 1945, an increase of 13,720 tons over the 42,771 tons shipped during 1944. The increase in shipments to consumers could largely be attributed to gains in shipments of die-cast and die scrap, especially aircraft forming-die scrap in the latter half of the year. Dealers bought up this material as fast as it was offered, and as a result there were sharp increases in shipments to consumers and in dealers' receipts of zinc scrap, which rose from 44,171 tons in 1944 to 59,477 tons in 1945. Stocks of 9,730 tons in dealers' yards and warehouses on December 31, 1945, were the highest on record.

In 1944, the use of monthly zinc-allocation certificates had been discontinued, but on February 27, 1945, General Preference Order M–11 was amended by the WPB, formally placing slab zinc again under allocation control. The allocation order was revoked on August 20, and thereafter no restrictions on the use of either zinc or zinc scrap remained in effect. On May 25, the OPA issued an amendment to Maximum Price Regulation 3, establishing a maximum price of 4.95 cents per pound for zinc-base forming and stamping dies sold as scrap. Explaining the creation of the new classification the agency said that expansion of the aircraft industry during the war had resulted in greatly increased use of forming and stamping dies made of zinc-base alloy. Because a larger volume of this material was expected to enter the scrap-metal market, and because industry had requested it, the additional classification of scrap was provided.

Ceiling prices for secondary slab zinc remained the same as in 1944, the price for Prime Western zinc being 8.25 cents a pound. Maximum prices for zinc scrap also remained unchanged, with new clippings at 7.25 cents a pound and old zinc at 5.75 cents. Dealers' buying prices for new zinc clippings averaged 5.83 cents a pound during 1945, which is a slight increase over the monthly average of 5.81 cents in 1944 and 0.62 cent less than the 1942 figure of 6.45 cents. The price in 1945 averaged 5.87 cents for January through October but dropped to 5.62 cents for November and December. The average price for old zinc was stationary at 4.37 cents during 1945, where it had remained since April 1944.

Imports of old zinc scrap into the United States totaled 3,308 tons in 1945, compared with 909 tons (revised figure) in 1944. Imported drosses and residues totaled 4,323 tons in 1945, a decrease of 371 tons from the 4,694 tons received from abroad in 1944. Large quantities of fume from a primary smelter in Canada were imported by one company for the manufacture of zinc sulfate and lithopone, but the zinc reclaimed from this material was not counted as secondary metal.

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IRON AND STEEL SCRAP

By NORWOOD B. MELCHER AND JAMES E. LARKIN

SUMMARY OUTLINE

GENERAL SUMMARY

The supply of iron and steel scrap in the United States was critically short throughout 1945. Except for a small increase in consumers' stocks in the Southeastern district, all districts reported declines from the previous year, indicating that suppliers were unable to meet the demand, even though requirements decreased considerably during the year. The pig-iron supply also became tighter during 1945, and the ratio of the average pig to total melt in all furnaces decreased from 50 percent in 1944 to 49 percent.

Consumption of iron and steel scrap during the first 2 months of 1945 continued at approximately the same level as in previous war years. In March consumption reached 5,476,000 short tons to establish the second highest [1] monthly rate on record. Total consumption in 1945 amounted to 56,191,085 short tons, compared with 61,349,201 tons in 1944—a 5.2-million ton decrease, most of which occurred in the last 5 months of the year, as a result of the cancellation of war contracts and the conversion of plants to peacetime production.

Manpower shortages, which restricted preparation of scrap by dealers, and the freight embargo in February, which curtailed shipments of scrap, forced consumers to draw from stock piles, resulting in a continuous decrease in inventories to a near-record low of 3,924,203 short tons on December 31—a drop of 11 percent from 1944. This lack of scrap, accompanied by a decrease in pig-iron production, resulted in a reduction in consumers' pig-iron stocks in December to 1,237,058 short tons, compared with 1,501,599 tons on December 31, 1944.

[1] A record total of 5,582,000 short tons of ferrous scrap was used in October 1941.

Salient statistics of ferrous scrap and pig iron in the United States, 1944–45

	1944	1945	Change in 1945 (percent)
Stocks, December 31:			
Ferrous scrap and pig iron at consumers' plants:	*Short tons*	*Short tons*	
Home scrap	1,435,056	1,218,493	−15
Purchased scrap	2,983,663	2,705,710	−9
Pig iron	1,501,599	1,237,058	−18
	5,920,318	5,161,261	−13
Ferrous scrap at suppliers' yards and producers' plants:			
Prepared scrap	769,860	[1] 1,457,000	−6
Unprepared scrap	780,638		
	1,550,498	1,457,000	−6
Total stocks of ferrous scrap at consumers' and producers' plants and at suppliers' yards	5,969,217	5,381,203	−10
Consumption:			
Ferrous scrap and pig iron charged to—			
Steel furnaces: [2]			
Home scrap	29,422,868	25,236,910	−14
Purchased scrap	18,193,639	17,919,602	−2
Pig iron	54,104,677	46,596,855	−14
	101,721,184	89,753,367	−12
Iron furnaces: [3]			
Home scrap	5,917,040	5,645,923	−5
Purchased scrap	6,467,220	6,115,066	−5
Pig iron	6,846,944	6,590,322	−4
	19,231,204	18,351,311	−5
Miscellaneous uses [4] and ferro-alloy production:			
Home scrap	86,441	77,871	−10
Purchased scrap	1,261,993	1,195,713	−5
	1,348,434	1,273,584	−6
All uses:			
Home scrap	35,426,349	30,960,704	−13
Purchased scrap	25,922,852	25,230,381	−3
Pig iron	60,951,621	53,187,177	−13
	122,300,822	109,378,262	−11
Ferrous scrap (total)	61,349,201	56,191,085	−8
Imports	131,376	66,511	−49
Exports:			
Iron and steel	90,453	79,259	−12
Tin plate, waste-waste, circles, strips, cobbles, etc	5,229	16,475	+215
Average prices per gross ton:			
Scrap:			
No. 1 Heavy-Melting, Pittsburgh [5]	$19.56	$20.00	+2
No. 1 Cast cupola [5]	20.00	20.00	
For export	22.35	30.30	+36
Pig iron, f. o. b. Valley furnaces: [5]			
Basic	23.50	25.25	+7
No. 2 Foundry	24.00	25.75	+7

[1] Estimated.
[2] Includes open-hearth, bessemer, and electric furnaces.
[3] Includes cupola, air, Brackelsberg, puddling, crucible, and blast furnaces; also direct castings.
[4] Includes rerolling, reforging, copper precipitation, nonferrous, and chemical uses.
[5] Iron Age.

The ferrous raw materials charged into steel-making furnaces during 1945 comprised 48 percent scrap and 52 percent pig iron, compared with 47 and 53 percent, respectively, during 1944. However, there was virtually no change with reference to iron furnaces, which used 64 percent scrap and 36 percent pig iron in 1945 and 1944. This increase of percentage in scrap used during 1945 over that of 1944 resulted in a substantial reduction in scrap inventories. Even though the pig-iron percentage of use was lower in 1945, consumers' stocks nevertheless declined owing to curtailed production.

Battlefield scrap has been considered a means for bolstering the dwindling supply of purchased scrap in the United States, but full utilization has not yet been deemed advisable because of the high alloy content and the presence of contaminating elements normally undesirable in steel compositions. These elements are copper, tin, cadmium, zinc, lead, and some boron and arsenic from enemy sources. Arsenic which is not removed in the melting process and is present in some German steels has a detrimental effect on the toughness of steel and its response to heat treatment. Therefore, it is felt that before battlefield scrap can be successfully used in making American steels it must be properly segregated. Dealers were not able to segregate this scrap properly due to the labor shortage, but since hostilities have ceased abroad it is expected that the battlefield scrap will be returned to the United States, properly segregated and will eventually flow into commercial channels.

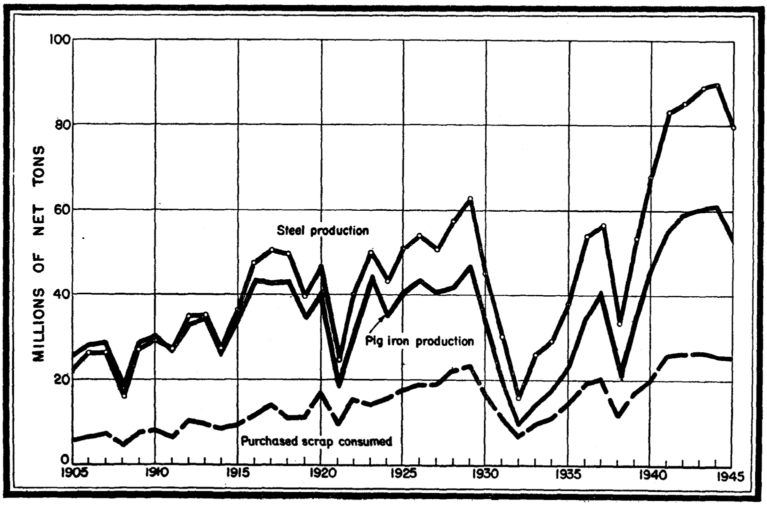

FIGURE 1.—Consumption of purchased scrap and output of pig iron and steel in the United States, 1905–45. Figures on consumption of purchased scrap for 1905–32 are from State of Minnesota vs. Oliver Iron Mining Co. et al., Exhibits, vol. 5, 1935, p. 328; those for 1933-34 are estimated by authors; and those for 1935–45 are based on Bureau of Mines reports. Data on output of steel are as given by the American Iron and Steel Institute.

The Bureau of Mines in its collection of the iron- and steel-scrap statistics reduced its wartime list of respondents greatly after September 1945. During the final war months reports were requested of 12,000 respondents, including producers, dealers, and consumers. Forms for October were mailed to only about 1,200 consumers and 900 dealers; the producer form (WPB 2903) was eliminated. Although less than half of the United States consumers were then canvassed, these companies used 97 percent of the United States consumption of total ferrous scrap and 98 percent of pig iron in 1945. Form WPB 2904 (consumers) was superseded by Bureau of Mines Form 6–1070–M and WPB 2905 (dealers and auto wreckers) by 6–1072–M.

WAR PRODUCTION BOARD

As of January 15, 1945, all basic open-hearth steel ingot producers were prohibited from accepting further shipments of electric furnace and foundry steel scrap. However, they were permitted to apply to the War Production Board requesting exceptions, furnishing complete information to justify departure from the terms of Direction 1 to General Preference Order M–24. The grades that the basic open-hearth consumers were prohibited from purchasing were the following: Billets, bloom and forge crops; bar crops and plate scrap; cast steel; punchings and plate scrap; electric furnace bundles; cut structural and plate scrap (3 feet and under); 1- and 2-foot foundry steel; springs and crank-shafts.

Direction 2 to General Preference Rating Order M–24, effective March 1, required consumers of scrap to take into account both home and purchased scrap in computing scrap inventories on hand. However, an inventory up to 50 tons was permitted regardless of the provision, for the benefit of small consumers.

In May the WPB revoked Conservation Order M–126 which banned the uses of iron and steel in less essential civilian products. This order, effective since May 1942, prohibited the use of iron and steel in a wide variety of products. Because of need for stainless steel by the armed forces, restrictions for this material were not lifted.

Scrap became increasingly scarce in July as material from industrial sources was reduced by military cut-backs while demand for steel continued strong. The scrap shortage became so serious that WPB allowed some steel makers to buy electric furnace grades for use in open-hearth, thus reducing the supply of the higher grades to electric furnace operators.

The WPB ceased allocation of scrap as of September 30, 1945, following the capitulation of Japan in August.

The functions of the WPB were transferred to the Civilian Production Administration on November 3, 1945.

OFFICE OF PRICE ADMINISTRATION

On April 14, 1945, the Office of Price Administration authorized scrap dealers to charge a commission of 50 cents per gross ton on material sold at the same price at which it was purchased, even though it was below ceiling. After November 16 a commission was allowed only on scrap bought and sold at ceilings. Other April 14 changes included provisions for railroad scrap specifications consistent with changes by the Association of American Railroads. They permitted Heavy-Melting steel from railroad equipment demolished by a dealer on railroad property to sell at the ceiling for railroad Heavy-Melting steel, resulting in an increase of $1 per ton over previous practice. Preparation-in-transit privilege was allowed on cast iron in zone C, which covers central and eastern areas. Provisions of iron- and steel-scrap regulation were extended to cover all export scrap or scrap sold to an exporter, making domestic maximum prices applicable to all export scrap sales.

STOCKS

Complete iron- and steel-scrap stock figures covering 1945 year end stocks are not available. The respondent list was cut sharply after September, the dealers canvassed during October held 67 percent of stocks based on maximum coverage, and automobile wreckers held only 27 percent of the total for that industry on the same basis. Producers (railroads and manufacturers) were not canvassed after September 1945. It is estimated that total stocks of iron and steel scrap on December 31, 1945, totaled 5,381,000 short tons—a decrease of 10 percent from 1944. This is the third consecutive year that stocks declined; at the end of 1943 stocks had declined 8 percent, and in 1944 a drop of 17 percent was experienced.

Most of the decline in 1945 was due to drops in consumers' stocks, both home and purchased. Dealers were unable to meet the high consumer demand for scrap in view of a greatly diminishing supply, especially from manufacturers.

CONSUMERS' STOCKS

Consumers' total home and purchased iron- and steel-scrap stocks on December 31, 1945, had decreased to 3,924,203 short tons or 11 percent from 4,418,719 tons at the beginning of the year. Stocks of home scrap (1,218,493 tons) had decreased 15 percent and purchased scrap (2,705,710 tons) 9 percent.

Stocks of pig iron on December 31, 1945, amounted to 1,237,058 short tons, an 18-percent decrease from the 1,501,599 tons on hand on December 31, 1944.

SUPPLIERS' AND PRODUCERS' STOCKS

Stocks of iron and steel scrap in the hands of dealers, automobile wreckers, railroads, and manufacturers decreased from 1,550,498 short tons on December 31, 1944, to an estimated 1,457,000 tons on December 31, 1945—a drop of 6 percent.

Consumers' stocks of ferrous scrap and pig iron on hand in the United States on Dec. 31, 1944, and Dec. 31, 1945, by States and districts, in short tons

State and district	Dec. 31, 1944				Dec. 31, 1945			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Connecticut	4,217	17,293	21,510	18,430	5,011	21,683	26,694	18,613
Maine	873	1,673	2,546	2,022	1,289	1,779	3,068	2,334
Massachusetts	12,712	46,690	59,402	89,753	15,015	35,925	50,940	26,980
New Hampshire	256	1,323	1,579	724	515	1,035	1,550	1,281
Rhode Island	1,191	5,961	7,152	3,639	699	2,988	3,687	5,239
Vermont	1,087	3,861	4,948	1,160	597	3,199	3,796	1,396
Total New England	20,336	76,801	97,137	115,728	23,126	66,609	89,735	55,843
Delaware, New Jersey	21,400	74,420	95,820	41,515	23,042	73,034	96,076	33,458
New York	51,445	173,906	225,351	78,363	54,134	168,579	222,713	58,009
Pennsylvania	627,521	467,610	1,095,131	329,087	472,546	461,511	934,057	302,262
Total Middle Atlantic	700,366	715,936	1,416,302	448,965	549,722	703,124	1,252,846	393,729
Alabama	36,775	44,166	80,941	90,987	46,032	94,753	140,785	66,745
District of Columbia, Kentucky, Maryland	46,832	85,108	131,940	34,973	57,984	74,546	132,530	25,172
Florida, Georgia	1,896	28,386	30,282	9,231	1,564	28,068	29,632	5,232
Mississippi	49	421	470	349	101	182	283	377
North Carolina	245	1,750	1,995	2,793	132	1,406	1,538	2,889
South Carolina	1,886	5,262	7,148	2,138	66	3,576	3,642	1,649
Tennessee, Virginia	4,779	42,549	47,328	23,442	4,987	34,656	39,643	14,932
West Virginia	4,516	51,308	55,824	22,943	6,334	59,536	65,870	31,039
Total Southeastern	96,978	258,950	355,928	186,856	117,200	296,723	413,923	148,035
Arkansas, Louisiana, Oklahoma	1,059	18,683	19,742	1,580	1,609	8,947	10,556	1,044
Texas	8,103	64,629	72,732	19,525	2,698	47,905	50,603	13,422
Total Southwestern	9,162	83,312	92,474	21,105	4,307	56,852	61,159	14,466
Illinois	111,436	353,420	464,856	134,746	112,375	391,471	503,846	113,915
Indiana	124,849	231,719	356,568	59,300	86,323	144,560	230,883	52,138
Iowa	1,789	36,310	38,099	17,920	3,324	20,333	23,657	15,665
Kansas, Nebraska	499	14,286	14,785	1,830	1,341	12,892	14,233	1,408
Michigan, Wisconsin	63,580	235,988	299,568	203,029	50,276	198,347	248,623	135,726
Minnesota	13,009	72,812	85,821	14,893	8,427	29,598	38,025	13,748
Missouri	4,324	88,429	92,753	8,693	3,629	57,114	60,743	7,402
North Dakota, South Dakota	1,333	151	1,484	54	387	127	514	111
Ohio	186,416	424,936	611,352	206,890	176,992	369,799	546,791	171,960
Total North Central	507,235	1,458,051	1,965,286	647,355	443,074	1,224,241	1,667,315	512,073
Arizona, Nevada, New Mexico	1,884	19,104	20,988	108	2,266	13,019	15,285	147
Colorado, Utah	34,413	128,450	162,863	20,576	40,698	105,068	145,766	46,718
Idaho	1	1,997	1,998	83	1	3,248	3,249	95
Wyoming	2	----------	2	8	4	1	5	7
Montana	2,624	14,145	16,769	248	2,118	11,442	13,560	185
Total Rocky Mountain	38,924	163,696	202,620	21,023	45,087	132,778	177,865	47,152
Alaska, Oregon	5,979	56,107	62,086	4,827	4,576	73,591	78,167	4,255
Washington, California	56,076	170,810	226,886	55,740	31,401	151,792	183,193	61,505
Total Pacific Coast	62,055	226,917	288,972	60,567	35,977	225,383	261,360	65,760
Total United States	1,435,056	2,983,663	4,418,719	1,501,599	1,218,493	2,705,710	3,924,203	1,237,058

CONSUMPTION

In gathering data on the consumption of scrap in 1945, the practice of the past few years was continued, in that figures on the use of scrap in the production of ferro-alloys and for various miscellaneous uses are included. Figures for some States are grouped to avoid disclosing the details of individual operations.

The large use of scrap as compared with that of pig iron again was noticeable in the New England, Southwestern, and Pacific Coast districts in 1945. These districts used 6 percent of the total scrap consumed in the United States, but only 2 percent of the total pig iron. The ratio of scrap to pig iron in these three districts was 3.20 : 1, whereas for the United States at large it was 1.06 : 1.

Open-hearth steel furnaces are by far the largest consumers of ferrous scrap and pig iron. The portions of the total scrap and pig-iron supply used in open-hearth furnaces have remained relatively constant, as the following data will show: Open-hearth consumption accounted for 67 percent of the total scrap in 1945, also 67 percent in 1944, and 65 percent in 1943; 73 percent of the home scrap in 1945, 73 percent in 1944, and 73 percent in 1943; and 60 percent of the purchased scrap in 1945, 57 percent in 1944, and 56 percent in 1943.

Cupola-furnace consumption in 1945 increased percentage-wise for home scrap and pig iron, but purchased scrap remained unchanged as follows: Home scrap, 12 percent of the total in 1945, 10 percent in 1944 and 1943; purchased scrap, 15 percent in 1945 and 1944, 17 percent in 1943; pig iron, 8 percent in 1945, 6 percent in 1944 and 1943.

Bessemer converters consumed 9 percent of the pig iron in 1945 (9 percent also in 1944) but only 0.6 percent of the scrap.

Electric furnaces consumed 9 percent of the total scrap in 1945 (10 percent in 1944) but only 0.3 percent of the pig iron.

Ferrous scrap and pig iron consumed in the United States and percent of total derived from home scrap, purchased scrap, and pig iron, 1944–45, by districts

District	1944					1945				
	Total used (short tons)	Percent of total used				Total used (short tons)	Percent of total used			
		Scrap			Pig iron		Scrap			Pig iron
		Home	Purchased	Total			Home	Purchased	Total	
New England	1,228,876	32.2	38.5	70.7	29.3	1,164,614	30.8	38.8	69.6	30.4
Middle Atlantic	42,712,527	29.0	18.5	47.5	52.5	36,813,199	28.2	20.2	48.4	51.6
Southeastern	15,021,937	25.7	18.4	44.1	55.9	13,666,270	25.4	20.0	45.4	54.6
Southwestern	708,436	27.3	50.3	77.6	22.4	765,941	26.8	49.4	76.2	23.8
North Central	57,469,322	30.1	21.3	51.4	48.6	52,224,035	29.2	23.6	52.8	47.2
Rocky Mountain	2,372,999	25.2	29.2	54.4	45.6	2,272,451	26.9	26.1	53.0	47.0
Pacific Coast	2,786,725	25.0	52.0	77.0	23.0	2,471,752	27.1	52.2	79.3	20.7
	122,300,822	29.0	21.2	50.2	49.8	109,378,262	28.3	23.1	51.4	48.6

Proportion of home and purchased scrap and pig iron used in furnace charges in the United States, 1944–45, in percent

Type of furnace	1944				1945			
	Scrap			Pig iron	Scrap			Pig iron
	Home	Purchased	Total		Home	Purchased	Total	
Open-hearth	29.2	16.6	45.8	54.2	28.5	19.0	47.5	52.5
Bessemer	4.6	1.9	6.5	93.5	4.6	1.7	6.3	93.7
Electric	47.2	49.2	96.4	3.6	45.3	51.6	96.9	3.1
Cupola	31.8	33.9	65.7	34.3	31.6	32.7	64.3	35.7
Air [1]	49.6	20.9	70.5	29.5	49.3	21.8	71.1	28.9
Crucible	41.3	17.2	58.5	41.5	32.8	26.3	59.1	40.9
Puddling	5.5	22.0	27.5	72.5	2.8	22.8	25.6	74.4
Blast	39.1	60.9	100.0		38.6	61.4	100.0	

[1] Includes data for 2 Brackelsberg furnaces.

Consumption of ferrous scrap and pig iron in the United States, 1944–45, by type of furnace, in short tons

Type of furnace or equipment	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
1944					
Open-hearth	146	26,006,327	14,801,730	40,808,057	48,281,168
Bessemer	36	274,237	112,359	386,596	5,583,027
Electric	382	3,142,304	3,279,550	6,421,854	240,482
Cupola	2,604	3,654,301	3,888,691	7,542,992	[1] 3,941,159
Air	126	837,621	353,265	1,190,886	499,457
Brackelsberg	2				
Crucible	18	859	359	1,218	863
Puddling	7	2,141	8,563	10,704	28,166
Blast	78	1,422,118	2,216,342	3,638,460	
Direct castings	35				2,377,299
Ferro-alloys	27	19,675	311,357	331,032	
Miscellaneous	151	66,766	950,636	1,017,402	
	[2] 3,612	35,426,349	25,922,852	61,349,201	60,951,621
1945					
Open-hearth	140	22,628,604	15,127,687	37,756,291	41,682,581
Bessemer	37	234,034	82,856	316,890	4,750,817
Electric	364	2,374,272	2,709,059	5,083,331	163,457
Cupola	2,532	3,614,006	3,729,761	7,343,767	[1] 4,084,091
Air	123	741,096	328,828	1,069,924	433,953
Brackelsberg	2				
Crucible	13	442	355	797	552
Puddling	7	842	6,982	7,824	22,725
Blast	74	1,289,537	2,049,140	3,338,677	
Direct castings	36				2,049,001
Ferro-alloys	21	19,088	292,707	311,795	
Miscellaneous	144	58,783	903,006	961,789	
	[2] 3,493	30,960,704	25,230,381	56,191,085	53,187,177

[1] Includes some pig iron used in making direct castings.
[2] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

CONSUMPTION BY DISTRICTS AND STATES

In 1945 iron and steel scrap and pig iron were used in all 48 States and the District of Columbia; none was used in Alaska. The largest consuming districts were the North Central, Middle Atlantic, and Southeastern. The Southwestern district showed an increase over 1944, but all other districts showed a decrease during the year. The nine States having the largest consumption of scrap, together with the percentage consumed, were: Pennsylvania 25, Ohio 18, Indiana 11, Illinois 10, Michigan 6, New York 5, Maryland 4, Alabama 3, and California 3. This order varies slightly from 1944; Michigan and Alabama changed positions, and California was added to the group. Pennsylvania, Ohio, Indiana, and Illinois remained as the leading States in iron- and steel-scrap consumption.

Consumption of ferrous scrap and pig iron in the United States, 1941–45, by districts

District and year	Active plants reporting	Scrap						Pig iron	
		Home		Purchased		Total			
		Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)	Short tons	Change from previous year (percent)
New England:									
1941	267	489,163	+72.5	566,952	+36.9	1,056,115	+51.4	476,768	+57.9
1942	271	494,569	+1.1	616,166	+8.7	1,110,735	+5.2	491,986	+3.2
1943	266	467,711	−5.4	538,469	−12.6	1,006,180	−9.4	412,523	−16.2
1944	255	396,205	−15.3	472,742	−12.2	868,947	−13.6	359,929	−12.8
1945	248	358,866	−9.4	451,237	−4.5	810,103	−6.8	354,511	−1.5
Middle Atlantic:									
1941	859	11,472,727	+39.9	7,796,243	+39.0	19,268,970	+39.6	20,787,804	+19.5
1942	914	11,190,820	−2.5	8,446,963	+8.3	19,637,783	+1.9	22,392,004	+7.7
1943	916	12,292,266	+9.8	8,251,262	−2.3	20,543,528	+4.6	22,815,315	+1.9
1944	880	12,395,873	+.8	7,907,164	−4.2	20,303,037	−1.2	22,409,490	−1.8
1945	858	10,401,507	−16.1	7,434,229	−6.0	17,835,736	−12.2	18,977,463	−15.3
Southeastern:									
1941	490	3,761,458	+19.9	2,825,903	+13.7	6,587,361	+17.1	7,699,004	+11.5
1942	526	3,669,073	−2.5	2,981,358	+5.5	6,650,431	+1.0	8,356,308	+8.5
1943	512	3,857,196	+5.1	2,540,189	−14.8	6,397,385	−3.8	8,247,742	−1.3
1944	501	3,861,555	+.1	2,763,586	+8.8	6,625,141	+3.6	8,396,796	+1.8
1945	485	3,474,945	−10.0	2,731,033	−1.2	6,205,978	−6.3	7,460,292	−11.2
Southwestern:									
1941	139	74,059	+86.7	215,699	+58.7	289,758	+65.0	5,707	+28.7
1942	138	101,683	+37.3	352,460	+63.4	454,143	+56.7	7,481	+31.1
1943	136	141,916	+39.6	454,731	+29.0	596,647	+31.4	27,813	+271.8
1944	134	193,181	+36.1	356,371	−21.6	549,552	−7.9	158,884	+471.3
1945	131	204,882	+6.1	378,618	+6.2	583,500	+6.2	182,441	+14.8
North Central:									
1941	1,424	17,227,439	+34.6	12,329,204	+28.1	29,556,643	+31.8	26,358,993	+26.0
1942	1,480	16,793,338	−2.5	12,814,917	+3.9	29,608,255	+.2	26,855,971	+1.9
1943	1,442	17,276,757	+2.9	12,685,489	−1.0	29,962,246	+1.2	27,605,420	+2.8
1944	1,426	17,284,440		12,281,465	−3.2	29,565,905	−1.3	27,903,417	+1.1
1945	1,380	15,237,692	−11.8	12,352,904	+.6	27,590,596	−6.7	24,633,439	−11.7
Rocky Mountain:									
1941	75	421,191	+61.5	446,745	+30.9	867,936	+44.2	645,038	+40.8
1942	87	436,470	+3.6	533,604	+19.4	970,074	+11.8	666,938	+3.4
1943	91	456,135	+4.5	570,034	+6.8	1,026,169	+5.8	722,221	+8.3
1944	92	598,494	+31.2	691,503	+21.3	1,289,997	+25.7	1,083,002	+50.0
1945	91	612,360	+2.3	592,431	−14.3	1,204,791	−6.6	1,067,660	−1.4
Pacific Coast:									
1941	277	458,643	+40.3	1,130,830	+29.2	1,589,473	+32.2	212,158	+12.0
1942	285	443,419	−3.3	1,390,311	+22.9	1,833,730	+15.4	272,195	+28.3
1943	317	545,107	+22.9	1,573,694	+13.2	2,118,801	+15.5	484,125	+77.9
1944	324	696,601	+27.8	1,450,021	−7.9	2,146,622	+1.3	640,103	+32.1
1945	300	670,452	−3.8	1,289,929	−11.0	1,960,381	−8.7	511,371	−20.1
United States:									
1941	[1] 3,531	33,904,680	+35.4	25,311,576	+29.9	59,216,256	+33.0	56,185,472	+21.7
1942	[1] 3,701	33,129,372	−2.3	27,135,779	+7.2	60,265,151	+1.8	59,042,883	+5.1
1943	[1] 3,680	35,037,088	+5.8	26,613,868	−1.9	61,650,956	+2.3	60,315,159	+2.2
1944	[1] 3,612	35,426,349	+1.1	25,922,852	−2.6	61,349,201	−.5	60,951,621	+1.1
1945	[1] 3,493	30,960,704	−12.6	25,230,381	−2.7	56,191,085	−8.4	53,187,177	−12.7

[1] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

Consumption of ferrous scrap and pig iron in the United States, in 1945, by States and districts

State and district	Active plants reporting	Scrap: Home, Short tons	Scrap: Home, Percent of total	Scrap: Purchased, Short tons	Scrap: Purchased, Percent of total	Scrap: Total, Short tons	Scrap: Total, Percent of total	Pig iron: Short tons	Pig iron: Percent of total
Connecticut	66	119,948	.4	153,494	.6	273,442	.5	104,676	.2
Maine	21	8,123	[1]	4,688	[1]	12,811	[1]	6,692	[1]
Massachusetts	118	185,320	.6	233,520	.9	418,840	.7	184,432	.3
New Hampshire	18	7,071	[1]	13,099	.1	20,170	[1]	8,908	[1]
Rhode Island	12	28,826	.1	34,430	.1	63,256	.1	38,670	.1
Vermont	13	9,578	[1]	12,006	[1]	21,584	[1]	11,133	[1]
Total New England	248	358,866	1.1	451,237	1.8	810,103	1.4	354,511	.7
Delaware	10	402,916	1.3	490,760	1.9	893,676	1.6	331,639	.6
New Jersey	111								
New York	231	1,471,581	4.8	1,202,413	4.8	2,673,994	4.8	2,598,306	4.9
Pennsylvania	506	8,527,010	27.5	5,741,056	22.7	14,268,066	25.4	16,047,518	30.2
Total Middle Atlantic	858	10,401,507	33.6	7,434,229	29.4	17,835,736	31.8	18,977,463	35.7
Alabama	89	1,249,302	4.0	594,795	2.4	1,844,097	3.3	2,884,295	5.4
District of Columbia	4	1,535,111	5.0	1,159,472	4.6	2,694,583	4.8	2,848,408	5.4
Kentucky	28								
Maryland	32								
Florida	19	49,549	.2	127,555	.5	177,104	.3	88,111	.2
Georgia	59								
Mississippi	13	1,009	[1]	2,022	[1]	3,031	[1]	1,023	[1]
North Carolina	54	11,216	[1]	8,265	[1]	19,481	[1]	22,886	[1]
South Carolina	21	3,297	[1]	17,552	.1	20,849	[1]	5,355	[1]
Tennessee	65	166,564	.5	176,597	.7	343,161	.6	176,736	.3
Virginia	68								
West Virginia	33	458,897	1.5	644,775	2.5	1,103,672	2.0	1,433,478	2.7
Total Southeastern	485	3,474,945	11.2	2,731,033	10.8	6,205,978	11.0	7,460,292	14.0
Arkansas	12	24,866	.1	33,056	.1	57,922	.1	7,944	[1]
Louisiana	27								
Oklahoma	21								
Texas	71	180,016	.6	345,562	1.4	525,578	.9	174,497	.3
Total Southwestern	131	204,882	.7	378,618	1.5	583,500	1.0	182,441	.3
Illinois	250	2,832,871	9.1	2,705,651	10.7	5,538,522	9.8	4,426,898	8.3
Indiana	156	3,726,118	12.0	2,297,717	9.1	6,023,835	10.7	6,543,439	12.3
Iowa	58	106,069	.3	209,334	.9	315,403	.6	83,412	.2
Kansas	32	25,632	.1	79,462	.3	105,094	.2	13,532	[1]
Nebraska	15								
Michigan	204	2,276,205	7.4	1,642,801	6.5	3,919,006	7.0	2,228,616	4.2
Wisconsin	133								
Minnesota	76	233,037	.8	278,206	1.1	511,243	.9	426,666	.8
Missouri	68	187,861	.6	588,925	2.3	776,786	1.4	106,734	.2
North Dakota	2	927	[1]	492	[1]	1,419	[1]	578	[1]
South Dakota	1								
Ohio	385	5,848,972	18.9	4,550,316	18.1	10,399,288	18.5	10,803,564	20.3
Total North Central	1,380	15,237,692	49.2	12,352,904	49.0	27,590,596	49.1	24,633,439	46.3
Arizona	12	8,136	[1]	70,838	.3	78,974	.2	133	[1]
Nevada	3								
New Mexico	4								
Colorado	28	595,494	1.9	493,526	2.0	1,089,020	1.9	1,067,032	2.0
Utah	26								
Idaho	6	874	[1]	4,759	[1]	5,633	[1]	495	[1]
Wyoming	1	1	[1]	6	[1]	7	[1]		
Montana	11	7,855	[1]	23,302	.1	31,157	.1		
Total Rocky Mountain	91	612,360	2.0	592,431	2.4	1,204,791	2.2	1,067,660	2.0
Oregon	50	120,473	.4	338,246	1.3	458,719	.8	34,834	.1
Washington	70								
California	180	549,979	1.8	951,683	3.8	1,501,662	2.7	476,537	.9
Total Pacific Coast	300	670,452	2.2	1,289,929	5.1	1,960,381	3.5	511,371	1.0
Total United States:									
1945	[2] 3,493	30,960,704	100.0	25,230,381	100.0	56,191,085	100.0	53,187,177	100.0
1944	[2] 3,612	35,426,349	100.0	25,922,852	100.0	61,349,201	100.0	60,951,621	100.0

[1] Less than 0.05 percent.
[2] Where 2 or more separate departments, such as blast-furnace, open-hearth, foundry, etc., are situated at the same place and are operated by 1 establishment, each appears as 1 plant in the total.

CONSUMPTION BY TYPE OF FURNACE

Open-hearth furnaces.—Ferrous scrap and pig iron consumed in open-hearth furnaces in 1945 totaled 79,438,872 short tons, an 11-percent decrease from 1944. The use of home scrap decreased 13 percent, purchased scrap increased 2 percent, total scrap decreased 7 percent, and pig iron decreased 14 percent.

Charges to open-hearth furnaces in 1945 consisted of 48 percent total scrap and 52 percent pig iron, compared with 46 percent and 54 percent, respectively, in 1944 and 1943. Of the total scrap consumed, 40 percent was purchased compared with 36 percent in 1944, and 37 percent in 1943.

Consumption of ferrous scrap and pig iron in open-hearth furnaces in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	1				
Massachusetts	2	111,236	231,104	342,340	135,624
Rhode Island	1				
Total: 1945	4	111,236	231,104	342,340	135,624
1944	4	122,679	225,381	348,060	151,208
Middle Atlantic:					
Delaware	1				
New Jersey	3	1,300,735	856,610	2,157,345	2,406,187
New York	8				
Pennsylvania	51	6,785,694	3,900,181	10,685,875	12,975,444
Total: 1945	63	8,086,429	4,756,791	12,843,220	15,381,631
1944	63	9,667,077	4,903,034	14,570,111	18,292,362
Southeastern and Southwestern:					
Alabama	2				
Georgia	1				
Tennessee	1	1,000,125	535,268	1,535,393	2,540,135
Texas	1				
District of Columbia	1				
Kentucky	2	1,795,200	1,252,909	3,048,109	3,660,374
Maryland	1				
West Virginia	2				
Total: 1945	11	2,795,325	1,788,177	4,583,502	6,200,509
1944	14	3,105,822	1,786,599	4,892,421	7,062,950
North Central:					
Illinois	11	1,844,479	1,519,269	3,363,748	3,157,159
Indiana	8	3,346,786	1,960,920	5,307,706	5,964,313
Michigan	4	910,606	473,044	1,383,650	1,390,380
Missouri	2				
Minnesota	1	286,847	559,303	846,150	432,857
Wisconsin	2				
Ohio	24	4,286,879	2,679,683	6,966,562	7,629,732
Total: 1945	52	10,675,597	7,192,219	17,867,816	18,574,441
1944	55	12,185,973	6,583,361	18,769,334	21,223,061
Rocky Mountain and Pacific Coast:					
Colorado	1				
California	7				
Utah	1	960,017	1,159,396	2,119,413	1,390,376
Washington	1				
Total: 1945	10	960,017	1,159,396	2,119,413	1,390,376
1944	10	924,776	1,303,355	2,228,131	1,551,587
Total United States: 1945	140	22,628,604	15,127,687	37,756,291	41,682,581
1944	146	26,006,327	14,801,730	40,808,057	48,281,168

Pennsylvania led in the use of scrap in the open-hearth in 1945, followed in order by Ohio, Indiana, and Illinois; this ranking is unchanged from 1944.

Bessemer converters.—The total of 5,067,707 short tons of ferrous raw materials used in bessemer converters in 1945 represents a 15-percent decrease from the 1944 use of these materials. The proportion of scrap in the metal charges was 6 percent, of which 74 percent was home scrap.

Following the usual pattern, Pennsylvania was the principal consumer of scrap in converters in 1945.

Consumption of ferrous scrap and pig iron in bessemer converters in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total	Pig iron
New England and Middle Atlantic:					
Connecticut	1				
Delaware	2	8,098	6,781	14,879	4,765
New York	2				
Pennsylvania	12	79,984	32,458	112,442	1,647,488
Total: 1945	17	88,082	39,239	127,321	1,652,253
1944	14	100,650	57,222	157,872	1,952,482
Southeastern and Southwestern:					
Alabama	1				
Maryland	1				
Mississippi	1	21,595	20,159	41,754	451,419
West Virginia	1				
Louisiana	1				
Texas	1				
Total: 1945	6	21,595	20,159	41,754	451,419
1944	6	27,570	23,682	51,252	594,974
North Central and Pacific Coast:					
Illinois	3	7,807	13,024	20,831	262,963
Indiana	1				
Iowa	1	19,437	9,889	29,326	324,672
Michigan	2				
Minnesota	1				
Missouri	1				
California	1	173	278	451	128
Washington	1				
Ohio	3	96,940	267	97,207	2,059,382
Total: 1945	14	124,357	23,458	147,815	2,647,145
1944	16	146,017	31,455	177,472	3,035,571
Total United States: 1945	37	234,034	82,856	316,890	4,750,817
1944	36	274,237	112,359	386,596	5,583,027

Electric steel furnaces.—Ferrous scrap and pig iron used in electric furnaces in 1945 amounted to 5,246,788 short tons, a decrease of 21 percent from the 6,662,336 tons used in 1944. The recent high consumption of ferrous raw materials in electric-furnace practice is a result of the increase in the number of these furnaces, which amounts to a 32-percent increase in electric-furnace capacity since 1942.

The decrease of 77,025 short tons of pig iron consumed in 1945 from the 1944 consumption is in large part due to a decrease of 47,051 tons in Ohio. This decrease continues a trend that became noticeable in 1943; a large plant in eastern Ohio which formerly used an unusually high percentage of pig iron in electric furnaces has altered melting practice to conform more nearly with that of the United States average.

Consumption of ferrous scrap and pig iron in electric steel furnaces in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	4				
New Hampshire	1	11,412	7,694	19,106	1,189
Rhode Island	1				
Massachusetts	12	22,937	15,697	38,634	589
Total: 1945	18	34,349	23,391	57,740	1,778
1944	19	45,890	27,940	73,830	2,099
Middle Atlantic:					
Delaware	1	78,967	54,477	133,444	1,133
New Jersey	13				
New York	21	85,152	101,613	186,765	7,405
Pennsylvania	62	645,923	584,904	1,230,827	14,722
Total: 1945	97	810,042	740,994	1,551,036	23,260
1944	97	1,082,151	910,029	1,992,180	29,794
Southeastern:					
District of Columbia	1				
Kentucky	1	32,976	65,593	98,569	542
Maryland	4				
West Virginia	1				
Alabama	5				
Florida	1	21,507	35,793	57,300	529
Georgia	3				
Mississippi	1				
North Carolina	1				
Tennessee	4	16,982	18,757	35,739	884
Virginia	4				
Total: 1945	26	71,465	120,143	191,608	1,955
1944	28	103,830	139,662	243,492	3,052
Southwestern:					
Arkansas	2				
Oklahoma	2	44,168	41,736	85,904	1,579
Louisiana	4				
Texas	10				
Total: 1945	18	44,168	41,736	85,904	1,579
1944	20	58,096	57,265	115,361	2,039
North Central:					
Illinois	26	355,114	427,955	783,069	11,173
Indiana	12	31,272	22,222	53,494	2,132
Iowa	2				
Kansas	2	12,209	10,835	23,044	520
Nebraska	1				
Michigan	28	179,830	223,319	403,149	20,739
Minnesota	4	5,460	7,296	12,756	218
Missouri	9	14,666	16,955	31,621	3,024
Ohio	38	571,795	723,222	1,295,017	87,628
Wisconsin	13	77,479	91,351	168,830	5,633
Total: 1945	135	1,247,825	1,523,155	2,770,980	131,067
1944	142	1,653,239	1,844,942	3,498,181	199,813
Rocky Mountain:					
Arizona	2				
Colorado	2	6,587	13,391	19,978	475
Nevada	1				
Utah	1				
Total: 1945	6	6,587	13,391	19,978	475
1944	6	8,248	15,113	23,361	310
Pacific Coast:					
Oregon	11	19,617	52,074	71,691	169
California	33	94,014	106,921	200,935	2,373
Washington	20	46,205	87,254	133,459	801
Total: 1945	64	159,836	246,249	406,085	3,343
1944	70	190,850	284,599	475,449	3,375
Total United States: 1945	364	2,374,272	2,709,059	5,083,331	163,457
1944	382	3,142,304	3,279,550	6,421,854	240,482

Cupola furnaces.—In 1945 cupola furnaces used 11,427,858 short tons of scrap and pig iron—virtually unchanged from 1944. The use of home scrap decreased 1 percent, purchased scrap decreased 4 percent, total scrap decreased 3 percent, but pig iron increased 4 percent. The decrease in purchased scrap and the increase in pig iron were due to the marked shortage of suitable cast scrap in relation to the availability of pig iron for cupola use. However, suppliers of foundry pig iron were short of meeting demands at the end of the year.

Charges to cupola furnaces consisted of 31 percent home scrap, 33 percent purchased scrap, and 36 percent pig iron, compared to 32, 34, and 34 percent, respectively, in 1944.

Michigan cupola furnaces used the largest tonnage of scrap in 1945, followed in order by those of Ohio, Illinois, Pennsylvania, New York, and Wisconsin.

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	51	60,767	40,755	101,522	64,178
Maine	21	8,123	4,688	12,811	6,692
Massachusetts	95	82,268	85,912	168,180	91,133
New Hampshire	15	2,338	12,441	14,779	6,802
Rhode Island	9	9,775	13,362	23,137	13,626
Vermont	13	9,578	12,006	21,584	11,133
Total: 1945	204	172,849	169,164	342,013	193,564
1944	210	178,342	172,126	350,468	178,958
Middle Atlantic:					
Delaware	5	3,146	3,479	6,625	2,909
New Jersey	75	102,697	138,210	240,907	135,072
New York	161	212,002	219,819	431,821	244,816
Pennsylvania	287	322,957	365,591	688,548	494,429
Total: 1945	528	640,802	727,099	1,367,901	877,226
1944	545	650,309	758,167	1,408,476	857,033
Southeastern:					
Alabama	68	227,373	126,435	353,808	517,738
District of Columbia	2	37,930	55,386	93,316	25,191
Maryland	22				
Florida	18	1,289	2,443	3,732	1,557
Georgia	53	17,846	29,025	46,871	26,877
Kentucky	23	19,770	16,877	36,647	60,627
Mississippi	11	698	1,522	2,220	1,023
North Carolina	53	11,169	8,265	19,434	22,801
South Carolina	20	3,297	2,400	5,697	5,355
Tennessee	57	96,236	66,338	162,574	121,567
Virginia	62	51,638	71,598	123,236	53,782
West Virginia	21	9,789	31,601	41,390	9,851
Total: 1945	410	477,035	411,890	888,925	846,369
1944	420	468,122	419,724	887,846	758,281
Southwestern:					
Arkansas	10	390	902	1,292	481
Louisiana	20	2,636	2,864	5,500	2,651
Oklahoma	18	5,563	11,263	16,826	4,145
Texas	54	26,896	73,272	100,168	25,105
Total: 1945	102	35,485	88,301	123,786	32,382
1944	103	32,577	92,441	125,018	25,949

Consumption of ferrous scrap and pig iron in cupola furnaces in the United States in 1945, by districts and States, in short tons—Continued

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
North Central:					
Illinois	178	426,059	351,170	777,229	356,465
Indiana	117	203,998	170,022	374,020	209,546
Iowa	53	85,684	89,969	175,653	79,982
Kansas	30	15,668	66,151	81,819	9,595
Michigan	159	641,486	522,545	1,164,031	513,657
Minnesota	64	48,638	97,006	145,644	45,049
Missouri	51	67,113	133,701	200,814	54,415
Nebraska	13	4,545	6,619	11,164	3,551
North Dakota	2	927	492	1,419	578
South Dakota	1				
Ohio	255	398,244	411,450	809,694	494,663
Wisconsin	106	252,220	177,050	429,270	215,745
Total: 1945	1,029	2,144,582	2,026,175	4,170,757	1,983,246
1944	1,052	2,176,488	2,077,845	4,254,333	1,981,076
Rocky Mountain:					
Arizona	5	6,397	18,700	25,097	1
Colorado	21	20,890	51,383	72,273	31,753
Idaho	5	550	1,801	2,351	155
Montana	8	7,438	5,428	12,866	338
New Mexico	2	132	2,899	3,031	21
Wyoming	1	1	6	7	2
Utah	15	21,960	41,220	63,180	26,863
Total: 1945	57	57,368	121,437	178,805	59,133
1944	58	55,622	144,704	200,326	51,138
Pacific Coast:					
California	125	65,419	133,325	198,744	72,523
Oregon	36	9,143	23,167	32,310	9,784
Washington	41	11,323	29,203	40,526	9,864
Total: 1945	202	85,885	185,695	271,580	92,171
1944	216	92,841	223,684	316,525	88,724
Total United States: 1945	2,532	3,614,006	3,729,761	7,343,767	[1] 4,084,091
1944	2,604	3,654,301	3,888,691	7,542,992	[1] 3,941,159

[1] Includes some pig iron used in making direct castings.

Air furnaces.—Scrap and pig iron consumed in air furnaces (including 2 Brackelsbergs) in 1945 amounted to 1,503,877 short tons, an 11-percent decrease from the 1,690,343 tons melted in these furnaces in 1944. The use of home scrap decreased 12, purchased scrap 7, and pig iron 13 percent.

There was a noteworthy change in the relative position of the principal consuming States; Indiana, which had been the fourth largest user for several years, dropped behind Michigan and Wisconsin into sixth position. Ohio led in the use of scrap in air furnaces, followed in order by Illinois, Pennsylvania, Michigan, Wisconsin, Indiana, and New York.

Consumption of ferrous scrap and pig iron in air furnaces [1] *in the United States in 1945, by districts and States, in short tons*

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	7	19,732	6,106	25,838	10,636
Massachusetts	3				
New Hampshire	1	19,191	8,355	27,546	12,443
Rhode Island	1				
Total: 1945	12	38,923	14,461	53,384	23,079
1944	12	43,108	15,498	58,606	27,359
Middle Atlantic:					
Delaware	1	11,443	2,604	14,047	7,727
New Jersey	2				
New York	12	41,406	14,120	55,526	27,485
Pennsylvania	25	99,222	51,152	150,374	61,433
Total: 1945	40	152,071	67,876	219,947	96,645
1944	40	181,660	76,231	257,891	115,572
Southeastern and Southwestern:					
West Virginia	2	14,416	10,360	24,776	23,819
Texas	1				
Total: 1945	3	14,416	10,360	24,776	23,819
1944	3	13,494	10,599	24,093	7,168
North Central:					
Illinois	15	181,304	80,138	261,442	116,416
Indiana	9				
Michigan	7	78,514	24,711	103,225	41,046
Iowa	1				
Minnesota	1	10,748	3,648	14,396	9,547
Missouri	1				
Ohio	22	194,508	93,148	287,656	90,719
Wisconsin	10	67,749	33,897	101,646	29,991
Total: 1945	66	532,823	235,542	768,365	287,719
1944	67	595,597	250,193	845,790	345,791
Rocky Mountain and Pacific Coast:					
Colorado	1				
California	2	2,863	589	3,452	2,691
Washington	1				
Total: 1945	4	2,863	589	3,452	2,691
1944	4	3,762	744	4,506	3,567
Total United States: 1945	125	741,096	328,828	1,069,924	433,953
1944	126	837,621	353,265	1,190,886	499,457

[1] Includes 2 Brackelsberg furnaces, 1 each in Indiana and Ohio.

Crucible and puddling furnaces.—Crucible furnaces used only 797 short tons of scrap and 552 tons of pig iron in 1945 compared with 1,218 and 863 tons, respectively, in 1944. Puddling furnaces used 30,549 tons of scrap and pig iron, a drop of 21 percent from 1944. Of the total puddling-furnace melt in 1945, 7,824 tons were scrap compared with 10,704 tons during the previous year. The bulk of the consumption was in Pennsylvania, as in 1944.

Consumption of ferrous scrap and pig iron in crucible and puddling furnaces in the United States in 1945, by districts and States in short tons

District and State	Active plants reporting	Scrap			Pig iron
		Home	Purchased	Total	
New England:					
Connecticut	1	334	299	633	288
Massachusetts	2				
New Hampshire	1				
Total: 1945	4	334	299	633	288
1944	3	467	213	680	103
Middle Atlantic and Southeastern:					
Maryland	1	6	3,636	3,642	8,190
New Jersey	1				
New York	1				
Kentucky	1				
Pennsylvania	9	911	3,372	4,283	14,611
Total: 1945	13	917	7,008	7,925	22,801
1944	16	2,280	8,688	10,968	28,385
North Central:					
Ohio	1	(1)	(1)	(1)	(1)
Total: 1945	1	(1)	(1)	(1)	(1)
1944	3	216	16	232	438
Southwestern and Pacific Coast:					
Oklahoma	1	(1)	(1)	(1)	(1)
California	1				
Total: 1945	2	(1)	(1)	(1)	(1)
1944	3	37	5	42	103
Total United States: 1945	20	1,284	7,337	8,621	23,277
1944	25	3,000	8,922	11,922	29,029

1 Included with total for United States.

Blast furnaces.—Materials other than scrap constitute by far the largest proportion of the blast-furnace charge and in 1945 were 81,072,236 short tons of iron and manganiferous ores, 17,284,828 tons of sinter, cinder, and mill scale, 3,450,162 tons of open-hearth and bessemer slag, 98,934 tons of raw flue dust, and 62,661 tons of miscellaneous materials.

Total consumption of scrap in 1945, as reported by 74 plants operating blast furnaces, was 3,338,677 short tons, an 8-percent decrease from 1944. These figures do not include 10,517 tons of home and 17,747 tons of purchased scrap used in blast furnaces in the manufacture of ferro-alloys. The scrap charged to blast furnaces was divided into 39 percent home and 61 percent purchased, as in 1944. In 1943, these percentages were 40 and 60, respectively. The ratio of scrap used to pig iron produced was 6.27 percent compared with 5.96 percent in 1944; purchased scrap accounted for 3.85 percent and home scrap 2.42 percent in 1945.

Consumption of ferrous scrap in blast furnaces in the United States in 1945, by districts and States, in short tons [1]

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
Middle Atlantic:				
New York	6	26,884	62,230	89,114
Pennsylvania	19	566,062	710,323	1,276,385
Total: 1945	25	592,946	772,553	1,365,499
1944	28	683,544	876,501	1,560,045
Southeastern:				
Alabama	7	145,178	142,946	288,124
Kentucky	1	72,387	272,780	345,167
Maryland	1			
Tennessee	1			
West Virginia	2			
Total: 1945	12	217,565	415,726	633,291
1944	12	241,592	377,986	619,578
North Central:				
Illinois	6	82,920	139,506	222,426
Indiana	3	49,515	97,704	147,219
Michigan	2	48,959	80,025	128,984
Minnesota	2			
Ohio	19	290,147	537,794	827,941
Total: 1945	32	471,541	855,029	1,326,570
1944	33	480,711	956,287	1,436,998
Southwestern: Rocky Mountain and Pacific Coast:				
Texas	1	7,485	5,832	13,317
Colorado	1			
Utah	2			
California	1			
Total: 1945	5	7,485	5,832	13,317
1944	5	16,271	5,568	21,839
Total United States: 1945	74	1,289,537	2,049,140	3,338,677
1944	78	1,422,118	2,216,342	3,638,460

[1] Does not include scrap used for the production of ferro-alloys.

USE OF SCRAP IN FERRO-ALLOY PRODUCTION

The production of ferro-alloys in 1945 consumed 311,795 short tons of scrap, a 6-percent decrease from the 1944 figure. Purchased scrap accounted for 94 percent of the quantity used and home scrap 6 percent. Twenty-one plants were engaged in this business, compared with 27 in 1944.

Of the scrap consumed in the manufacture of ferro-alloys, 9 percent was used in blast furnaces and 91 percent in electric furnaces; and 469 tons were used in the aluminothermic process.

Of a total of 21 ferro-alloy plants which used iron and steel scrap in 1945, 3 operated blast furnaces, and 18 employed electric furnaces. One of the latter group also used the aluminothermic process.

Consumption of ferrous scrap by ferro-alloy producers in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap		
		Home	Purchased	Total
Middle Atlantic:				
New York	6	498	71,678	72,176
Pennsylvania	2		843	843
Total: 1945	8	498	72,521	73,019
1944	10	832	78,047	78,879
North Central:				
Iowa	1	18,580	134,743	153,323
Ohio	5			
Total: 1945	6	18,580	134,743	153,323
1944	6	18,814	140,258	159,072
Southeastern:				
Alabama	1	10	75,596	75,606
South Carolina	1			
Tennessee	1			
West Virginia	1			
Total: 1945	4	10	75,596	75,606
1944	5		83,345	83,345
Pacific Coast:				
California	1		9,847	9,847
Oregon	1			
Washington	1			
Total: 1945	3		9,847	9,847
1944	6	29	9,707	9,736
Total United States: 1945	21	19,088	292,707	311,795
1944	27	19,675	311,357	331,032

MISCELLANEOUS USES

Slightly less than 2 percent of the 1945 consumption of scrap was for miscellaneous purposes, such as rerolling, in nonferrous metallurgy, and as a chemical agent. The quantity so used—961,789 short tons—was a decrease of 5 percent from that used for these purposes in 1944. Of the quantity used 94 percent was purchased and 6 percent home scrap.

Consumption of ferrous scrap in miscellaneous uses in the United States in 1945, by districts and States, in short tons

District and State	Active plants reporting	Scrap: Home	Scrap: Purchased	Scrap: Total
New England:				
Massachusetts	4	28	11,671	11,699
Connecticut	1			
Total: 1945	5	28	11,671	11,699
1944	5	967	11,219	12,186
Middle Atlantic:				
New Jersey	17	3,479	92,556	96,035
New York	12	1,132	70,128	71,260
Pennsylvania	25	26,257	92,232	118,489
Total: 1945	54	30,868	254,916	285,784
1944	55	32,122	263,286	295,408
Southeastern:				
Alabama	4	113	27,439	27,552
Georgia	2	1,095	911	2,006
Tennessee	1			
Maryland	1	669	70,497	71,166
Virginia	2			
West Virginia	1			
Total: 1945	11	1,877	98,847	100,724
1944	13	1,762	98,842	100,604
Southwestern:				
Louisiana	2	242	32,364	32,606
Texas	3			
Total: 1945	5	242	32,364	32,606
1944	4	216	26,136	26,352
North Central:				
Illinois	8	4,330	199,530	203,860
Indiana	5	15,433	21,416	36,849
Michigan	2	2,103	24,198	26,301
Nebraska	1			
Wisconsin	2			
Minnesota	2	301	507	808
Missouri	4		34,919	34,919
Ohio	9	353	82,168	82,521
Total: 1945	33	22,520	362,738	385,258
1944	38	27,530	397,276	424,806
Rocky Mountain:				
Arizona	5	11	45,404	45,415
Nevada	2			
New Mexico	2			
Colorado	2	762	25,644	26,406
Idaho	1			
Montana	3			
Utah	6	2,061	37,991	40,052
Total: 1945	21	2,834	109,039	111,873
1944	21	3,815	122,280	126,095
Pacific Coast:				
California	8	385	31,299	31,684
Oregon	2	29	2,132	2,161
Washington	5			
Total: 1945	15	414	33,431	33,845
1944	15	354	31,597	31,951
Total United States: 1945	144	58,783	903,006	961,789
1944	151	66,766	950,636	1,017,402

FOREIGN TRADE[2]

Imports.—Imports of iron and steel scrap in 1945 decreased 59 percent in quantity (46,271 short tons as compared with 111,974 tons in 1944) and 66 percent in value ($555,471 as compared to $1,627,117 in 1944). Of the 1945 imports, 29,603 tons came from Canada, 5,070 from Cuba, 3,914 from Curaçao, and the remainder in small tonnages from other countries. In addition, 20,240 tons of tin-plate scrap were imported (18,851 tons from Canada) as compared with 19,402 tons in 1944 and 21,927 tons in 1943.

Exports.—Exports of ferrous scrap from the United States in 1945 were 95,734 short tons valued at $2,589,239, a negligible increase in tonnage but an increase of 36 percent in value over 1944. Exports exceeded imports by 49,463 short tons (not counting 20,240 tons of imported tin-plate scrap). The tonnage exported amounted to slightly less than 3 percent of the 5-year prewar average (for 1935-39) of 3,298,326 tons a year. The high requirement for scrap in the United States and the chaotic conditions abroad were the major factors causing the low level of exports. The 1945 exports included 16,475 tons of tin-plate scrap, circles, strips, cobbles, and waste and terneplate clippings and scrap valued at $1,359,360. The same materials in 1944 amounted to 5,229 tons valued at $446,971. The accompanying table shows the principal countries to which scrap was exported during the period 1941–45.

Ferrous scrap exported from the United States, 1941–45, by countries, in short tons

Country	1941	1942	1943	1944	1945
Brazil	20			271	1,088
Canada	314,555	121,471	34,085	71,518	47,465
Chile		203	615	72	7,447
Colombia	73	366	155	1,819	955
Japan	324				
Mexico	30,119	15,502	18,157	17,509	27,471
United Kingdom	539,650	142	115		199
Uruguay				220	4,432
Other countries	19,508	4,052	1,767	4,273	6,677
Total	904,249	141,736	54,894	95,682	95,734
Total value	$15,973,863	$3,321,523	$1,070,809	$1,910,226	$2,589,239

REVIEW BY COUNTRIES

Argentina.—Decree 1,143 of January 16, 1945, fixed maximum prices on scrap iron in Argentina at 50 pesos per ton for first-class-quality scrap iron and at 30 pesos per ton for second-class-quality. The decree also stated that scrap iron is considered critical material and comes under Decree 29,671, which places critical materials under the control of the Secretariat of Industry and Commerce.[3]

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.
[3] U. S. Dept. of Commerce, Foreign Commerce Weekly: Vol. 19, No. 3, Apr. 14, 1945, p 14.

Canada.—Production of steel ingots and castings in Canada in 1945 totaled 2,881,323 short tons, a decrease of 5 percent from 1944. Of the 1945 output, 2,747,206 tons were ingots compared with 2,878,-407 tons in 1944. Alloy steel produced in 1945 amounted to 290,710 tons. Pig iron consumed in steel furnaces totaled 1,397,631 tons in 1945 and 1,511,518 tons in 1944. Iron- and steel-scrap consumption in 1945 totaled 1,775,819 tons, of which 925,482 tons was home scrap and 850,337 tons purchased scrap. In 1944 home- and purchased-scrap consumption in steel furnaces amounted to 1,007,473 tons and 842,471 tons, respectively.

There was a short supply of virtually all grades of scrap throughout 1945. However, the situation was less critical during the summer months, when transportation was not hindered by inclement weather.

Poland.—Collection of scrap iron in Poland was resumed in March 1945, and by the end of the year 152,390 tons had been collected.[4]

Sweden.—The supply of all raw materials for steel production in Sweden was critically short. There were virtually no imports of scrap iron during the first 8 months of 1945, and domestic strikes reduced production of scrap, which previously amounted to 10,000 tons per month. Sweden had counted on importing some scrap from the Baltic area, but it became apparent that Russia would require all of this scrap for its own needs. About 20,000 tons of scrap are expected from Belgium under a new Belgian-Swedish trade agreement.[5]

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[4] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 5, May 20, 1946, p. 13.
[5] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 5, Nov. 20, 1945 p. 6.

IRON ORE

By Norwood B. Melcher and John Hozik

SUMMARY OUTLINE

SUMMARY

An 11-percent decline in steel production, accompanied by a proportional easing of pig-iron requirements, resulted in a 6-percent decrease in iron-ore production during 1945. Decreases occurred in all major districts, and the Lake Superior district maintained its usual position and supplied 85 percent of the United States total during the year. The labor supply became worse during 1945—mines in the Lake Superior district were obliged to transfer into production work men who would normally be utilized for development work in underground mines. A critical labor shortage in Alabama resulted in the shipping of 115,000 tons of ore from stock piles at Gary, Ind., to furnaces in the Birmingham district. Total employment at iron mines and mills decreased from an average of 29,244 men in 1944 to 26,900 in 1945.

The iron-mining companies of the Lake Superior district were aided by price increases that were effective for the entire 1945 season. The increases ranged from 10 to 20 cents per gross ton but applied only to ore shipped for sale. The industry considered these increases inadequate, and further increases were being sought at the close of the year.

Iron ore reentered the United States import trade in quantity during 1945, especially in the closing months of the year. Trade in Chilean ore, which was suspended early in the War, was resumed in August, and a total of 214,670 tons had entered the United States by the end of the year. Canadian ore imports increased from 255,431 tons in 1944 to 704,225 tons in 1945 as a result of expanded production at the Steep Rock mine near Atikokan, Ontario. Ore from North Africa entered the United States in quantity during 1945. Algeria supplied 221,526 tons compared with 134,104 tons in 1944 and 89,766 tons in 1943; Tunisia shipped 10,382 tons (all during the last 2 months). Imports from all countries amounted to 1,193,514 gross tons compared with 463,532 tons in 1944.

Salient statistics of iron ore in the United States, 1944–45

	1944		1945	
	Gross tons	Value	Gross tons	Value
Crude iron ore:				
Production by districts:				
Lake Superior	88, 294, 284	(1)	85, 451, 692	(1)
Southeastern	11, 469, 700		9, 616, 593	
Northeastern	7, 749, 541		7, 686, 338	
Western	3, 506, 620		3, 557, 776	
	111, 020, 145	(1)	106, 312, 399	(1)
Production by mining methods:				
Open pit	82, 393, 899	(1)	78, 935, 218	(1)
Underground	28, 626, 246		27, 377, 181	
	111, 020, 145	(1)	106, 312, 399	(1)
Production by types of ore:				
Hematite	96, 238, 818	(1)	92, 161, 239	(1)
Brown ore	5, 265, 700		4, 397, 650	
Magnetite	9, 514, 555		9, 752, 711	
Carbonate	1, 072		799	
	111, 020, 145	(1)	106, 312, 399	(1)
Shipments	112, 073, 286	(1)	106, 538, 936	(1)
Iron ore: [2]				
Production by districts:				
Lake Superior	79, 111, 320	(1)	74, 821, 045	(1)
Southeastern	7, 121, 676		6, 329, 987	
Northeastern	3, 849, 396		3, 620, 147	
Western	3, 442, 405		3, 087, 774	
Undistributed (byproduct ore)	592, 908		517, 440	
	94, 117, 705	(1)	88, 376, 393	(1)
Production by types of product:				
Direct	73, 260, 136	(1)	67, 768, 993	(1)
Concentrates	16, 648, 364		16, 812, 961	
Sinter	3, 616, 297		3, 276, 999	
Byproduct material (pyrites cinder and sinter)	592, 908		517, 440	
	94, 117, 705	(1)	88, 376, 393	(1)
Production by types of ore:				
Hematite	86, 726, 870	(1)	81, 294, 688	(1)
Brown ore	1, 218, 509		942, 910	
Magnetite	5, 578, 807		5, 620, 810	
Carbonate	611		545	
Byproduct material (pyrites cinder and sinter)	592, 908		517, 440	
	94, 117, 705	(1)	88, 376, 393	(1)
Shipments	95, 135, 675	$256, 885, 512	88, 136, 715	$243, 760, 986
Average value per ton at mine		2.70		2.77
Stocks at mines Dec. 31	4, 136, 639	(1)	4, 431, 970	(1)
Imports	463, 532	2, 007, 865	1, 193, 514	4, 100, 344
Exports	2, 158, 447	7, 163, 405	2, 063, 125	6, 688, 156
Consumption	99, 942, 454	(1)	86, 158, 495	(1)
Manganiferous ore: [3]				
Shipments	1, 327, 324	3, 855, 946	1, 359, 691	3, 513, 666

[1] Data not available.
[2] Ore cotaining less than 5 percent manganese.
[3] Ore containing 5 to 35 percent manganese.

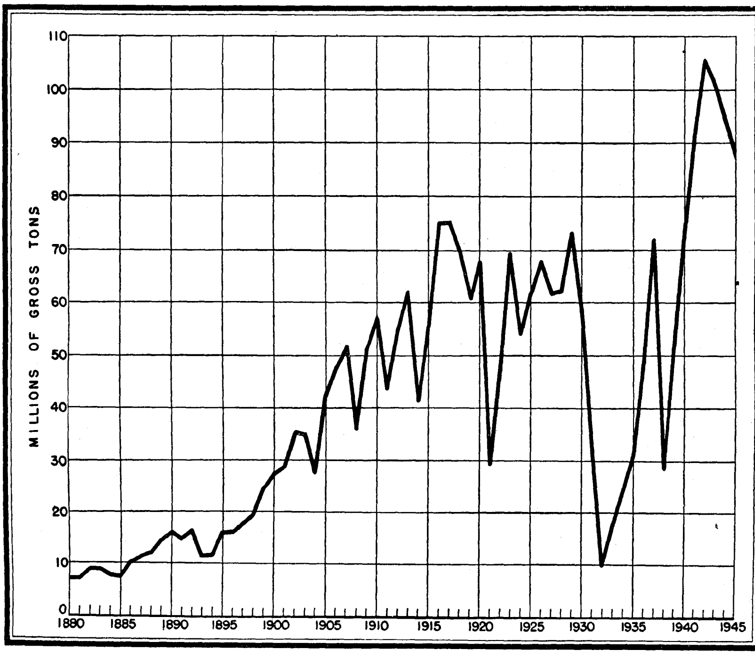

FIGURE 1.—Trends in production of iron ore in the United States, 1880–1945.

PRODUCTION AND SHIPMENTS

United States iron-ore mines produced crude ore totaling 106,312,399 gross tons and shipped 106,538,936 tons in 1945—decreases of 4 and 5 percent, respectively, from 1944. Of the 1945 shipments, 36 percent was sent to beneficiation plants and 64 percent went direct to consumers, compared with 34 percent and 66 percent, respectively, in 1944. From the crude ore shipped to beneficiation plants, 16,812,961 tons of concentrate and 3,276,999 tons of sinter were produced. In addition, 517,440 tons of byproduct cinder and sinter were produced by the pyrites industry. In all, 88,376,393 gross tons of usable iron ore were produced at mines and mills in 1945. Output came from 199 mines, of which 28 mined over 1,000,000 tons of crude ore each. Minnesota, with 61,620,337 tons, supplied 70 percent of the usable ore; and Michigan, with 11,832,493 tons or 13 percent, was the second-largest producer. These two States and Wisconsin, with 1,368,215 tons or 2 percent, constitute the Lake Superior region, which supplied 85 percent of the domestic output. About three-fourths of the iron ore mined in 1945 came from open-pit mines.

Shipments of usable ore from mines totaled 87,580,942 gross tons in 1945. Of this quantity, 67,994,160 tons (78 percent) were direct shipping ore for all uses. Total shipments also included 1,562 tons for cement manufacture, 9,642 tons for paint, and 106,069 tons for miscellaneous uses. Shipments of byproduct ore for use in iron and steel totaled 555,773 tons in 1945 valued at $2,758,954.

Crude iron ore mined in the United States, 1944–45, by States and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1944					1945				
	Number of mines	Hematite	Brown ore	Magnetite	Total	Number of mines	Hematite	Brown ore	Magnetite	Total
Alabama	[1] 28	6,517,770	3,530,348		10,048,118	[1] 21	5,704,605	2,551,510		8,256,115
Arkansas	1			76	76					
California	4	695,233		150,027	845,260	3	141,823		138,750	280,573
Colorado						1	117			117
Georgia	[1] 8		1,414,990		1,414,990	[1] 5		1,352,050		1,352,050
Michigan	43	12,826,240			12,826,240	42	11,865,624			11,865,624
Minnesota	103	74,061,059			74,061,059	95	72,217,853			72,217,853
Missouri	[1] 4	10,232	9,050		19,282	[1] 2	253,591	4,000		257,591
Nevada	3			36,581	36,581	2			6,196	6,196
New Jersey	4			1,087,948	1,087,948	4			855,470	855,470
New Mexico	1			33,460	33,460	1			369	369
New York	7	1,239		6,659,282	[2] 6,661,593	7	2,392		6,820,177	[3] 6,839,296
Pennsylvania	2					3		15,928		
Virginia	1		6,592		6,592	1				
South Dakota	1		1,038		1,038	1		4,162		4,162
Texas	4	2,503	303,682		306,185	4	1,014	470,000		471,014
Utah	5	3		1,542,281	1,542,284	4			1,931,749	1,931,749
Washington	2	3,795		4,900	8,695					
Wisconsin	2	1,406,985			1,406,985	2	1,368,215			1,368,215
Wyoming	1	713,759			713,759	1	606,005			606,005
Total	[1] 224	96,238,818	5,265,700	9,514,555	[2] 111,020,145	[1] 199	92,161,239	4,397,650	9,752,711	[3] 106,312,399

[1] Excludes an undetermined number of small pits. Output of these pits included in tonnage given.
[2] Includes 1,072 tons of carbonate ore.
[3] Includes 799 tons of carbonate ore.

Crude iron ore mined in the United States, 1944–45, by States and mining methods, in gross tons

State	1944			1945		
	Open pit	Underground	Total	Open pit	Underground	Total
Alabama	3,533,642	6,514,476	10,048,118	2,551,510	5,704,605	8,256,115
Arkansas	76		76			
California	845,260		845,260	280,573		280,573
Colorado				117		117
Georgia	1,414,990		1,414,990	1,352,050		1,352,050
Michigan	2,150,891	10,675,349	12,826,240	564,278	11,301,346	11,865,624
Minnesota	69,152,136	4,908,923	74,061,059	68,022,925	4,194,928	72,217,853
Missouri	16,813	2,469	19,282	257,591		257,591
Nevada	6,597	29,984	36,581	6,196		6,196
New Jersey		1,087,948	1,087,948		855,470	855,470
New Mexico	33,460		33,460	369		369
New York	3,376,973	3,284,620	6,661,593	3,492,684	3,346,612	6,839,296
Pennsylvania						
Virginia	6,592		6,592			
South Dakota	1,038		1,038	4,162		4,162
Texas	306,185		306,185	471,014		471,014
Utah	1,542,284		1,542,284	1,931,749		1,931,749
Washington	6,962	1,733	8,695			
Wisconsin		1,406,985	1,406,985		1,368,215	1,368,215
Wyoming		713,759	713,759		606,005	606,005
	82,393,899	28,626,246	111,020,145	78,935,218	27,377,181	106,312,399

Crude iron ore shipped from mines in the United States, 1944–45, by States and disposition, in gross tons

State	1944			1945		
	Direct to consumers	To beneficiation plants	Total	Direct to consumers	To beneficiation plants	Total
Alabama	5,007,952	5,049,364	10,057,316	4,697,438	3,551,458	8,248,896
Arkansas	76		76			
California	614,913	54,100	669,013	259,021	138,750	397,771
Colorado				117		117
Georgia		1,414,990	1,414,990		1,352,050	1,352,050
Michigan	13,693,377		13,693,377	11,816,671	49,515	11,866,186
Minnesota	50,775,368	23,475,225	74,250,593	47,127,414	25,302,406	72,429,820
Missouri	19,293		19,293	4,000	253,591	257,591
Nevada	32,281		32,281	6,196		6,196
New Jersey	116,163	969,591	1,085,754	126,394	725,482	851,876
New Mexico	33,460		33,460	369		369
New York	145,004	6,558,315	6,703,319	124,140	6,701,524	6,825,664
Pennsylvania						
Virginia		6,806	6,806			
South Dakota	1,038		1,038	4,162		4,162
Texas	2,503	303,682	306,185	1,014	470,000	471,014
Utah	1,540,594		1,540,594	1,925,572		1,925,572
Washington	8,695		8,695			
Wisconsin	1,536,737		1,536,737	1,295,647		1,295,647
Wyoming	713,759		713,759	606,005		606,005
	74,241,213	37,832,073	112,073,286	67,994,160	38,544,776	106,538,936

Iron ore mined in the United States, 1944–45, by mining districts and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

Variety of ore	Lake Superior district	Birmingham	Chattanooga	Adirondack and Cornwall	New Jersey and S. E. New York	Other	Total
1944							
Crude ore:							
Hematite	88,294,284	6,517,770				1,426,764	96,238,818
Brown ore		1,216,100	1,523,460			2,526,140	5,265,700
Magnetite				6,659,282	1,087,948	1,767,325	9,514,555
Carbonate						1,072	1,072
	88,294,284	7,733,870	1,523,460	6,659,282	1,087,948	5,721,301	111,020,145
Iron ore:							
Hematite	79,111,320	6,188,786				1,426,764	86,726,870
Brown ore		243,336	306,732			668,441	1,218,509
Magnetite				3,347,814	499,732	1,731,261	5,578,807
Carbonate						611	611
	79,111,320	6,432,122	306,732	3,347,814	499,732	3,827,077	93,524,797
1945							
Crude ore:							
Hematite	85,451,692	5,704,605				1,004,942	92,161,239
Brown ore		716,700	1,435,550			2,245,400	4,397,650
Magnetite				6,820,177	855,470	2,077,064	9,752,711
Carbonate						799	799
	85,451,692	6,421,305	1,435,550	6,820,177	855,470	5,328,205	106,312,399
Iron ore:							
Hematite	74,821,045	5,612,962				860,681	81,294,688
Brown ore		144,044	292,745			506,121	942,910
Magnetite				3,185,402	430,308	2,005,100	5,620,810
Carbonate						545	545
	74,821,045	5,757,006	292.745	3,185,402	430,308	3,372,447	87,858,953

Iron ore produced in the United States, 1944–45, by States and types of product, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1944					1945				
	Direct shipping ore	Sinter [1]	Concentrates	Total	Iron content, natural (percent)	Direct shipping ore	Sinter [1]	Concentrates	Total	Iron content, natural (percent)
Mined ore:										
Alabama	4,997,889	1,173,231	658,317	6,829,437	36.18	4,704,412	901,498	442,652	6,048,562	35.87
Arkansas	76			76	64.47					
California	791,160		18,036	809,196	53.47	141,823		66,786	208,609	55.74
Colorado						117			117	56.20
Georgia			285,523	285,523	46.46			276,050	276,050	45.10
Michigan	12,826,240			12,826,240	51.84	11,816,109		16,384	11,832,493	51.83
Minnesota	50,602,129	160,983	14,114,983	64,878,095	51.95	46,944,837	112,451	14,563,049	61,620,337	52.08
Missouri	19,282			19,282	54.09	4,000		109,330	113,330	54.86
Nevada	36,581			36,581	64.09	6,196			6,196	64.14
New Jersey	116,013		383,719	499,732	62.54	126,673		303,635	430,308	63.58
New Mexico	33,460			33,460	56.16	369			369	60.00
New York	162,042	2,282,083	905,539	3,349,664	64.19	113,312	2,263,050	818,852	3,195,214	63.82
Pennsylvania					56.33					56.40
Virginia			6,716	6,716	37.25					31.50
South Dakota	1,038			1,038	40.00	4,162			4,162	40.00
Texas	2,503		275,531	278,034	46.50	1,014		216,223	217,237	46.71
Utah	1,542,284			1,542,284	52.58	1,931,749			1,931,749	52.84
Washington	8,695			8,695	27.81					
Wisconsin	1,406,985			1,406,985	52.64	1,368,215			1,368,215	52.66
Wyoming	713,759			713,759	53.84	606,005			606,005	51.86
	73,260,136	3,616,297	16,648,364	93,524,797	51.20	67,768,993	3,276,999	16,812,961	87,858,953	51.33
Byproduct ore: [2]										
Delaware		592,908		592,908	62.52		517,440		517,440	59.98
Michigan					66.00					66.00
Tennessee					67.60					68.01
Virginia					59.00					59.00
		592,908		592,908	63.77		517,440		517,440	64.76
Total	73,260,136	4,209,205	16,648,364	94,117,705	51.29	67,768,993	3,794,439	16,812,961	88,376,393	51.41

[1] Exclusive of sinter produced at consuming plants.
[2] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Iron ore produced in the United States, 1944–45 by States and varieties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	1944				1945			
	Hematite	Brown ore	Magnetite	Total	Hematite	Brown ore	Magnetite	Total
Alabama	6,188,786	640,651		6,829,437	5,612,962	435,600		6,048,562
Arkansas			76	76				
California	695,233		113,963	809,196	141,823		66,786	208,609
Colorado					117			117
Georgia		285,523		285,523		276,050		276,050
Michigan	12,826,240			12,826,240	11,832,493			11,832,493
Minnesota	64,878,095			64,878,095	61,620,337			61,620,337
Missouri	10,232	9,050		19,282	109,330	4,000		113,330
Nevada			36,581	36,581			6,196	6,196
New Jersey			499,732	499,732			430,308	430,308
New Mexico			33,460	33,460			369	369
New York	1,239		3,347,814	[1] 3,349,664	2,392		3,185,402	[2] 3,195,214
Pennsylvania						6,875		
Virginia		6,716		6,716				
South Dakota		1,038		1,038		4,162		4,162
Texas	2,503	275,531		278,034	1,014	216,223		217,237
Utah	3		1,542,281	1,542,284			1,931,749	1,931,749
Washington	3,795		4,900	8,695				
Wisconsin	1,406,985			1,406,985	1,368,215			1,368,215
Wyoming	713,759			713,759	606,005			606,005
	86,726,870	1,218,509	5,578,807	[1] 93,524,797	81,294,688	942,910	5,620,810	[2] 87,858,953
Byproduct ore: [3] Delaware, Michigan, Tennessee, Virginia				592,908				517,440
Grand total	86,726,870	1,218,509	5,578,807	[1] 94,117,705	81,294,688	942,910	5,620,810	[2] 88,376,393

[1] Includes 611 tons of carbonate ore.
[2] Includes 545 tons of carbonate ore.
[3] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

Shipments of iron ore in the United States, in 1945, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Iron and steel			Cement	Paint	Miscellaneous	Total	
	Direct shipping ore	Sinter [1]	Concentrates				Gross tons	Value
Mined ore:								
Alabama	4,697,438	898,690	442,503				6,038,631	$14,547,223
California	259,021					67,274	326,295	1,050,338
Colorado	117						117	(2)
Georgia			276,050				276,050	616,524
Michigan	11,816,671		16,384				11,833,055	35,313,135
Minnesota	47,127,414	112,451	14,330,111				61,569,976	156,942,255
Missouri	3,700		108,668		300		112,668	(2)
Nevada	2,793			88		3,315	6,196	(2)
New Jersey	126,394		298,857	1,319	86	2,091	428,747	2,956,510
New Mexico	369						369	(2)
New York	121,748	2,255,220 (New York and Pennsylvania)	524,764		2,392	[3] 33,389		
Pennsylvania					2,702 (Pennsylvania and Virginia)		2,940,215 (New York, Pennsylvania, Virginia)	21,457,890
Virginia						(4)		
South Dakota					4,162		4,162	(2)
Texas	1,014		216,223				217,237	705,736
Utah	1,925,417			155			1,925,572	2,170,334
Wisconsin	1,295,647						1,295,647	3,575,133
Wyoming	606,005						606,005	(2)
Undistributed								[5] 1,666,954
	67,983,748	3,266,361	16,213,560	1,562	9,642	106,069	87,580,942	241,002,032
Byproduct ore: [6] Delaware, Michigan, Pennsylvania, Tennessee, Virginia		555,773					555,773	2,758,954
Grand total	67,983,748	3,822,134	16,213,560	1,562	9,642	106,069	88,136,715	243,760,986

[1] Exclusive of sinter produced at consuming plants.
[2] Value included with "Undistributed."
[3] Includes Virginia.
[4] Included with New York.
[5] Includes values for States entered as "2."
[6] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

PRINCIPAL MINES

In this discussion, the size of a mine is determined by the quantity of crude ore excavated. Consequently, mines providing low-grade ores, which require concentration, will be comparable in size to mines producing similar quantities of direct shipping ores. Twenty-eight mines, each yielding more than 1,000,000 gross tons of crude ore, produced 56 percent of the United States output in 1945. Of these producers, 19 were in Minnesota, 3 in Alabama, 3 in New York, and 1 each in Utah, Wisconsin, and Pennsylvania; 20 were open-pit operations, 5 underground, and 3 combination mines. Except for 5 mines that produced magnetite, all the million-ton mines produced hematite.

Iron-ore mines in the United States in 1945, by size of crude output

Name of mine	State	Nearest town	Range or district	Mining method	Production (gross tons)	
					Crude ore	Usable ore
Hull-Rust-Burt-Sellers-Penobscot	Minnesota	Hibbing	Mesabi	Open pit	19, 574. 394	19, 335, 766
Rouchleau-Moose	do	Virginia	do	do	4, 051, 625	4, 051, 625
Hill Annex	do	Calumet	do	do	3, 024, 001	1, 861, 821
Mountain Iron	do	Virginia	do	do	2, 679, 798	2, 679, 798
Hill-Trumball	do	Marble	do	do	1, 800, 876	836, 685
Benson	New York	Star Lake	Adirondack	do	1, 558, 457	603, 986
Embarrass	Minnesota	Biwabik	Mesabi	do	1, 519, 911	1, 519, 911
Mahoning	do	Hibbing	do	do	1, 516, 704	1, 516, 704
Wenonah	Alabama	Bessemer	Birmingham	Underground	1, 462, 135	(1)
Fraser D'Autremont	Minnesota	Chishol	Mesabi	Open pit	1, 343, 742	1, 343, 742
Gross Marble	do	Marble	do	do	1, 315, 873	718, 810
Muscoda	Alabama	Bessemer	Birmingham	Underground	1, 266, 896	(1)
Kevin	Minnesota	Cooley	Mesabi	Open pit	1, 259, 907	523, 325
Canisteo	do	Coleraine	do	do	1, 234, 205	659, 836
Ishkooda	Alabama	Bessemer	Birmingham	Underground	1, 216, 291	[2] 3, 945, 322
Morrison-Lewis-Walker	Minnesota	Coleraine	Mesabi	Open pit	1, 192, 583	726, 722
Mississippi	do	Keewatin	do	do	1, 169, 406	827, 742
Leonard-Burt-Glen	do	Chisholm	do	do	1, 163, 567	1, 163, 567
Spruce	do	Eveleth	do	Combined	1, 147, 285	1, 147, 285
Bingham-North Star	do	Taconite	do	Open pit	1, 126, 818	746, 818
Iron Mountain	Utah	Cedar City	Iron Mountain	do	1, 114, 466	1, 114, 466
Montreal	Wisconsin	Montreal	Gogebic	Underground	1, 113, 929	1, 113, 929
Webb	Minnesota	Hibbing	Mesabi	Combined	1, 064, 218	955, 683
Susquehanna	do	do	do	Open pit	1, 053, 692	961, 851
Danube	do	Bovey	do	do	1, 008, 562	656, 426
Cornwall	Pennsylvania	Lebanon	Cornwall	Combined		
New Bed-Harmony-Old Bed	New York	Mineville	Adirondack	Underground	3, 873, 310	2, 074, 119
MacIntyre	do	Tahawus	do	Open pit		
Carol	Minnesota	Nashwauk	Mesabi	do	982, 954	522, 093
Olson	do	Cooley	do	do	919, 265	446, 550
Harrison	do	do	do	do	909, 696	330, 419
Pyne	Alabama	Bessemer	Birmingham	Underground	902, 856	902, 856
Missabe Mountain	Minnesota	Virginia	Mesabi	Open pit	841, 560	841, 560
Hodge Mining Co.	Georgia	Taylorsville	Chattanooga	do	830, 000	165, 724
Weggum	Minnesota	Hibbing	Mesabi	do	813, 334	541, 197
Chateaugay	New York	Lyon Mountain	Adirondack	Underground	790, 990	242, 497
Morris	Minnesota	Hibbing	Mesabi	Open pit	780, 434	780, 434
Buck	Michigan	Iron River	Menominee	Underground	764, 175	764, 175
Bennett	Minnesota	Keewatin	Mesabi	Open pit	753, 098	683, 389
Scranton	do	Hibbing	do	Underground	728, 140	728, 140
Douglas	do	Chisholm	do	Open pit	693, 388	484, 486
Fayal No. 3	do	Eveleth	do	Combined	680, 988	680, 988
Negaunee	Michigan	Negaunee	Marquette	Underground	654, 447	654, 447

See footnotes at end of table.

Iron-ore mines in the United States in 1945, by size of crude output—Continued

Name of mine	State	Nearest town	Range or district	Mining methods	Production (gross tons)	
					Crude ore	Usable ore
Davis-Geneva-West Davis	Michigan	Ironwood	Gogebic	Underground	636,378	636,378
Buckeye	Minnesota	Grand Rapids	Mesabi	Open pit	635,841	355,169
Hartley	do	Chisholm	do	do	630,869	630,869
Hawkins	do	Nashwauk	do	do	627,003	381,864
La Grange	Alabama	Leighton	Russellville	do	610,314	63,972
Godfrey	Minnesota	Chisholm	Mesabi	Underground	606,383	606,383
Sunrise	Wyoming	Sunrise	Hartville	do	606,005	606,005
Zenith	Minnesota	Ely	Vermilion	do	603,000	603,000
Prindle	do	Virginia	Mesabi	Open pit	597,517	597,517
Scranton-South Rust	do	Hibbing	do	do	594,099	594,099
Draper Annex	do	Greenway Twp	do	do	589,864	410,218
Newport	Michigan	Ironwood	Gogebic	Underground	569,084	569,084
Russellville Nos. 5 and 12	Alabama	Russellville	Russellville	Open pit	564,996	95,727
Maas	Michigan	Negaunee	Marquette	Underground	563,288	563,288
Cliffs Shaft	do	Ishpeming	do	do	558,836	558,836
Duncan	Utah	Cedar City	Iron Mountain	Open pit	544,912	544,912
Aromac	Minnesota	Nashwauk	Mesabi	do	541,018	238,850
Hiawatha 1 and 2	Michigan	Iron River	Menominee	Underground	540,208	540,208
Wabigon	Minnesota	Buhl	Mesabi	Open pit	537,931	518,153
Penn Group	Michigan	Norway and Vulcan	Menominee	Underground	534,024	534,024
Tobin-Columbia	do	Crystal Falls	do	do	516,290	516,290
Output of 64 mines producing more than 500,000 tons crude ore each					84,105,836	70,019,740
Output of 11 mines producing 400,000 to 500,000 tons crude ore each					5,109,855	4,092,230
Output of 13 mines producing 300,000 to 400,000 tons crude ore each					4,332,099	3,477,559
Output of 28 mines producing 200,000 to 300,000 tons crude ore each					6,719,820	5,634,635
Output of 27 mines producing 100,000 to 200,000 tons crude ore each					4,019,357	3,178,426
Output of 17 mines producing 50,000 to 100,000 tons crude ore each					1,282,624	960,099
Output of 39 mines producing under 50,000 tons crude ore each					426,971	343,982
Output from reprocessed tailings (1 plant)					315,837	152,282
Grand total of United States (199 [3] mines and 1 reprocessing plant)					106,312,399	87,858,953

[1] Included with Ishkooda.
[2] Includes Muscoda and Wenonah.
[3] Excludes an undetermined number of small pits. The output of these pits is included in the total given.

BENEFICIATION

Iron ore is concentrated by washing, jigging, tabling, and magnetic and high-density separation to remove objectionable impurities, thereby improving its grade. Fine ores are agglomerated or sintered into lumps, which are desirable in blast and steel furnaces because of their porous character and their improved grade and structure. Sintering likewise has a beneficial effect by reducing the sulfur and moisture content. At many mines the ore is crushed and screened to improve its physical characteristics, but ore known to be so improved is not included in the statistics on beneficiated ore.

In 1945, 20,089,960 gross tons of beneficiated ore were produced from 38,544,776 tons of crude ore. Beneficiation of iron ore was reported at 99 mines in 11 States in 1945 compared with 104 mines in 9 States in 1944. Beneficiated ore shipped from domestic mine plants in 1945 decreased 4 percent from 1944 and totaled 19,586,782 tons; concentrates comprised 19 percent and sinter 4 percent of total usable ore shipments.

The ratio of crude ore used to usable ore produced was 1.919:1 in 1945 compared with 1.867:1 in 1944.

Iron ore shipped from mines in the United States, 1925–29 (average), and 1941–45, in gross tons, and percentage of beneficiated ore compared to total shipped

[Exclusive of ore containing 5 percent or more manganese and ore sold for paint]

Year	Beneficiated	Total	Proportion of beneficiated to total (percent)	Year	Beneficiated	Total	Proportion of beneficiated to total (percent)
1925–29 (av.)	8,653,590	66,697,126	13.0	1943	[1] 20,117,685	[1] 98,817,470	20.4
1941	19,376,120	93,053,994	20.8	1944	[1] 20,303,422	[1] 94,544,635	21.5
1942	[1] 23,104,945	[1] 105,313,653	21.9	1945	[1] 19,586,782	[1] 87,580,942	22.4

[1] Includes ore for paint.

SINTER

Domestic sintering plants in 1945 used 10,835,840 gross tons of iron ore, 4,859,550 tons of flue dust, 493,587 tons of mill cinder and roll scale, 571,396 tons of pyrites cinder, and 1,184 tons of aniline sludge to produce 14,985,517 tons of sinter—a loss in weight of 11 percent.

Sinter production in 1945 came from plants at mines, blast-furnace plants, custom mills, and a number of rotary cement kilns converted to iron-ore roasting. Of the sinter produced in the United States in 1945, 22 percent was made at mine plants in 4 States and 78 percent was produced at blast-furnace plants and custom mills in 14 States.

Production and consumption of sinter in the United States in 1945, by States, in gross tons

State	Sinter produced	Sinter consumed: In blast furnaces	Sinter consumed: In steel furnaces
Alabama	1,401,633	1,608,562	69,581
California	802,912	809,715	1,390
Colorado			------
Utah			------
Delaware	137,867	------	------
Illinois	581,526	614,666	1,259
Indiana	939,346	818,805	119,927
Maryland	------	825,788	------
Kentucky	420,086		74,053
Tennessee			------
West Virginia			------
Michigan	302,176	234,863	68,581
Minnesota	112,451		------
New York	2,996,800	601,753	144,154
Ohio	3,871,849	3,455,308	408,856
Pennsylvania	3,415,871	3,580,820	265,706
	14,985,517	12,550,280	1,153,507

AVERAGE VALUE

The average value per gross ton of iron ore at mines was $2.77 in 1945 compared with $2.70 in 1944.

Average value per gross ton of iron ore at mines in the United States, 1944–45

[Exclusive of ore containing 5 percent or more manganese]

State	1944							1945						
	Direct			Concentrates				Direct			Concentrates			
	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter	Hematite	Brown ore	Magnetite	Hematite	Brown ore	Magnetite	Sinter
Mined ore:														
Alabama	$2.32	(1)	-----	(1)	$2.98	-----	(1)	$2.23	-----	-----	(1)	$2.72	-----	(1)
Georgia	-----	-----	-----	-----	2.41	-----	-----	-----	-----	-----	-----	2.23	-----	-----
Michigan	2.81	-----	-----	-----	-----	-----	-----	2.98	-----	-----	(1)	-----	-----	-----
Minnesota	2.43	-----	-----	$2.54	-----	-----	$2.80	2.52	-----	-----	$2.63	-----	-----	(1)
Missouri	5.66	(1)	-----	-----	-----	-----	-----	-----	(2)	-----	(2)	-----	-----	-----
New Jersey	-----	-----	(1)	-----	-----	$6.97	-----	-----	-----	(1)	-----	-----	$7.01	-----
New Mexico	-----	-----	(1)	-----	-----	-----	-----	-----	-----	(2)	-----	-----	-----	-----
New York	(1)	-----	(1)	-----	-----	5.78	-----	(1)	-----	(1)	-----	-----	5.94	-----
Pennsylvania	-----	-----	-----	-----	-----		7.96		-----	-----	-----	(1)		$7.64
Utah	(1)	-----	$1.13	-----	-----	-----	-----	-----	-----	$1.13	-----	-----	-----	-----
Wisconsin	2.73	-----	-----	-----	-----	-----	-----	(2)	-----	-----	-----	-----	-----	-----
Other [3]	1.88	$4.00	6.64	-----	3.36	8.96	-----	2.40	$4.94	6.29	4.53	4.33	7.91	-----
Average, all States	2.49	4.52	2.18	2.55	2.93	6.30	6.28	2.58	4.94	1.69	2.64	2.96	6.44	6.27
Byproduct ore: [4]														
Delaware, Michigan, Pennsylvania, Tennessee, Virginia	-----	-----	-----	-----	-----	-----	4.92	-----	-----	-----	-----	-----	-----	4.96

[1] Included with average for all States.
[2] Included with other States in 1945.
[3] Includes Arkansas and Washington in 1944, and Colorado, Missouri, New Mexico, and Wisconsin in 1945. Also includes California, Nevada, South Dakota, Texas, Virginia, and Wyoming in 1944 and 1945.
[4] Cinder and sinter obtained from pyrites treated in, but not necessarily mined in, States indicated.

The accompanying table gives the average value at the mines of the different classes of iron ore in 1945 for each of the producing States or groups of States, except when there are fewer than three shippers of a certain class of ore in a State and permission was not given to publish the value. These data are taken directly from statements of producers and probably represent the commercial selling prices only approximately. In general, the delivered cost less transportation costs to the consuming plant is given. In the Lake Superior district the mine value is the Lake Erie price less freight from mines to Lower Lake ports. This value appears to be applied also to ore which is not sold on the open market.

CONSUMPTION

A total of 86,158,495 gross tons of iron ore was reported consumed in 1945. Of this, 83 percent was consumed in iron blast furnaces, 12 percent in sintering plants, 4 percent in steel furnaces, and less than 1 percent in ferro-alloy furnaces. The 115,711 tons of "paint" and "all other" ore shipped from mines and mills in 1945 were assumed to have gone directly into consumption.

Consumption of iron ore in the United States, in 1945, by States and uses, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State	Metallurgical uses				Miscellaneous uses			Total
	Iron blast furnaces	Steel furnaces	Sintering plants	Ferro-alloy furnaces	Cement	Paint [1]	All other [1]	
Alabama	5,942,379	13,679	1,154,294	----	25,506	----	----	7,135,858
California					20,583	----	67,274	
Colorado	1,706,598	125,210	850,463	----	610	----	----	2,771,150
Utah					412	----	----	
Illinois	7,659,310	287,995	300,247	----	71	----	----	8,247,623
Indiana	9,222,961	530,422	447,701	8,022	----	----	----	10,209,106
Kentucky	3,333,181		32,765	----	2,813	----	----	
Maryland		343,659	----	----	838	----	----	3,713,256
Massachusetts	----		----	----	----	----	----	
Tennessee	2,239,248	----	----	----	2,155	----	----	2,427,711
Michigan		83,248	103,060	----	----	----	----	
Minnesota	739,220	62,524	155,684	----	----	----	----	957,428
Missouri	----	----	----	----	20	300	----	320
Nevada	----	----	----	----	----	----	3,315	3,315
New Jersey	----	----	----	----	----	86	2,091	2,177
New York	4,580,084	218,622	2,515,250	121,414	1,405	[2] 4,460	[2] 33,389	[2] 7,475,509
Ohio	13,489,829	566,382	2,527,190	266,084	660	----	----	16,850,145
Pennsylvania	20,297,153	1,162,730	2,749,186	4,789	5,764	634	----	24,220,256
South Dakota	----	----	----	----	----	4,162	----	4,162
West Virginia	2,108,040	14,484	----	----	----	----	----	2,133,845
Texas		----	----	----	11,321	----	----	
Virginia	----	----	----	----	885	(3)	(3)	(3)
Washington	----	----	----	----	303	----	----	303
Other States [4]	----	----	----	----	6,331	----	----	6,331
	71,318,003	3,408,955	10,835,840	400,309	79,677	9,642	106,069	86,158,495

[1] Shipments from domestic mines.
[2] Includes Virginia.
[3] Data included with New York.
[4] Florida, Idaho, Kansas, Louisiana, Maine, Montana, and Oregon.

STOCKS OF IRON ORE

Stocks of usable iron ore at mines on December 31, 1945, increased 7 percent over 1944. Of the quantity in stock piles, 40 percent was at mines in Michigan, 31 percent in Minnesota, and 4 percent in Wisconsin—a total of 75 percent in the Lake Superior district.

Stocks of crude ore at mines totaled 2,685,495 gross tons on December 31, 1945, compared with 2,869,226 tons in 1944.

Stocks of iron ore at consuming plants totaled 34,642,259 gross tons on December 31, 1945, compared with 32,914,774 tons at the end of 1944.

Stocks of usable iron ore at mines, December 31, 1944–45, by States, in gross tons

State	1944	1945	State	1944	1945
Alabama	44,353	54,284	New Jersey	2,431	3,992
California	232,179	114,493	New York	658,245	909,690
Michigan	1,798,028	1,775,824	Pennsylvania	2,799	6,651
Minnesota	1,263,251	1,355,035	Virginia	144	
Missouri	31	693	Utah	13,476	19,652
Nevada	4,400	1,786	Wisconsin	117,302	189,870
				4,136,639	4,431,970

FOREIGN TRADE[1]

Imports of iron ore were two and one-half times as great as in 1944.

Iron ore imported for consumption in the United States, 1943–45, by countries, in gross tons

Country	1943		1944		1945	
	Gross tons	Value	Gross tons	Value	Gross tons	Value
Algeria	89,766	$443,744	134,104	$555,703	221,526	$930,807
Brazil			7	37		
Canada[1]	279,222	1,229,520	255,431	1,191,936	704,225	2,618,069
Chile					214,670	386,406
Colombia			10	33		
Cuba			96	695	145	1,053
France					2,419	7,257
Italy					500	2,000
Mexico	16,740	59,680	62,630	183,335	37,728	81,098
Morocco, French	13,074	77,354	7,449	37,085	1,200	6,000
Oceania, French	2	10				
Peru					13	60
Tunisia			3,539	22,597	10,382	37,120
United Kingdom	313	16,725	266	16,444	706	30,474
	399,117	1,827,033	463,532	2,007,865	1,193,514	4,100,344

[1] Includes pyrites cinder.

Exports of iron ore, of which virtually all went to Canada, totaled 2,063,125 gross tons valued at $6,688,156. Canada received 2,062,992 tons valued at $6,684,499. Relatively insignificant quantities went to Colombia, Cuba, Mexico, Trinidad and Tobago, and United Kingdom.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

REVIEW OF LAKE SUPERIOR DISTRICT

Production and shipments.—Production of iron ore from mines in the Lake Superior district in 1945 was 5 percent lower than in 1944 but supplied 85 percent of the United States total compared with 84 percent in 1944. The Mesabi, largest of the six producing ranges, supplied 78 percent of the district total and 66 percent of the United States total. In addition to 74,821,045 gross tons of iron ore produced in the Lake district, 1,197,097 tons of manganiferous ore were produced, making a total output of all grades of 76,018,142 tons. The total shipments of 75,956,291 tons consisted of 1,257,613 tons containing over 5 percent manganese and 74,698,678 tons containing less than 5 percent.

Increased shipments from the Steep Rock mine, although smaller than expected, raised Canadian output; the Josephine-Ruth mine did not begin production in 1945, as was planned. Statistics covering output of these mines are not included in the Lake Superior totals.

The Lake Superior Iron Ore Association reported 74,752,161 tons of iron and manganiferous ore shipped to Upper Lake ports from United States mines in 1945, a decrease of 7 percent from 1944. All-rail shipments totaled 1,208,710 gross tons in 1945 compared with 1,182,995 tons in 1944. The 1945 shipping season opened early, and 7,235,142 tons were shipped from United States ports during April compared with 5,254,400 in April 1944. The first ore was loaded at Escanaba on April 2, 1945, and at the same port April 5 of the previous year. The final cargo of iron ore from the Lake Superior district was carried by the vessel *J. C. Williams*, which cleared Escanaba harbor on December 5. In 1944, the final cargo left Ashland harbor on November 28.

Iron ore produced in the Lake Superior district, 1854–1945, by ranges, in gross tons

[Exclusive after 1905 of ore containing 5 percent or more manganese]

Year	Marquette	Menominee	Gogebic	Vermilion	Mesabi	Cuyuna	Total
1854–1943	225,053,662	201,447,840	237,478,238	74,237,762	1,314,036,795	31,390,054	2,083,644,351
1944	4,720,253	4,288,830	5,224,142	1,466,816	61,994,023	1,417,256	79,111,320
1945	4,664,816	4,140,239	4,395,653	1,481,007	58,355,320	1,784,010	74,821,045
Total	234,438,731	209,876,909	247,098,033	77,185,585	1,434,386,138	34,591,320	2,237,576,716

Mining developments.—The trend from dependence on direct shipping ore to concentration of low-grade ores continued in 1945. The new screening-washing plant of the Inter-State Iron Co., at the Columbia mine at Virginia, Minn., which was operated experimentally in 1944, was put into full operation. A new washing plant at the Wabigon mine was completed in 1945. A second cone for high-density separation was installed at the Patrick plant at Cooley; there are now four plants on the Mesabi range using this method. Several new conveyor belts for moving ore from pit to loader or beneficiation plant were installed during the year. Among these were conveyors at the Gross Marble and Hill Annex mines. Development of the Jordan Reserve, 5 miles southwest of Grand Rapids, continued during 1945. This will be the westernmost mine on the Mesabi.

Research on the concentration of low-grade Mesabi ores was accelerated during 1945. Extensive work is being carried on by various companies, the Minnesota Mines Experiment Station, Minneapolis, and the Battelle Memorial Institute, Columbus, Ohio. In addition, the Oliver Iron Mining Co. is building a large laboratory at Duluth to study further present methods of concentration and the concentration of taconites, both magnetic and nonmagnetic. The Iron Range Rehabilitation and Resources Commission recently appropriated $300,000 for an experimental powdered iron plant on the Mesabi range, and $25,000 for a pilot plant to process peat for fuel in roasting iron ore and for other purposes.

The last important mine on the lower Menominee range, the Penn group, was exhausted and abandoned late in the year, after shipping 604,339 tons of ore during the 1945 season and having shipped almost continuously since 1887.

Exploration by the Federal Geological Survey and the Michigan Geological Survey Division continued during 1945.

Average costs, per gross ton, of mining iron ore at underground mines and at siliceous open pits in Michigan in 1945 [1]

Item	Underground				Siliceous open pits
	Gogebic	Marquette	Menominee	Average	
Cost of mining:					
Labor	$1.4657	$1.6948	$1.1478	$1.4367	$0.3074
Supplies	.6673	.7270	.5463	.6460	.2629
Deferred costs	.2628	.0473	.1348	.1366	.0431
Taxes	.2519	.2350	.1150	.2019	.0665
General overhead	.2180	.2264	.1551	.1984	.1235
Transportation	1.8875	1.5771	1.6725	1.7114	1.5604
Marketing	.0602	.0984	.0843	.0828	.0824
Total ore cost	4.8134	4.6060	3.8558	4.4138	2.4462
Lake Erie value per ton	4.9958	4.8960	4.5289	4.7849	2.6955
Gross ore profit [2]	.1824	.2900	.6731	.3711	.2493
Other costs:					
Royalty	.3222	.2032	.2118	.2388	.0882
Interest on borrowed money		.0402	.0007	.0152	.0062
Federal income and excess profits	.0942	.1122	.1400	.1174	.0359

[1] Pardee, F. G., General Statistics Covering Costs and Production of Michigan Iron Mines: Michigan Dept. of Conservation, Geol. Survey Div., 1946, 9 pp.
[2] This figure does not represent true profit, as much ore is sold below the Lake Erie price.

Analyses.—The following table was compiled by the Lake Superior Iron Ore Association.

Average analyses of total tonnages (bill-of-lading weights) of all grades of iron ore from all ranges of Lake Superior district, 1941–45

Year	Gross tons	Iron (natural)	Phosphorus	Silica	Manganese	Moisture
		Percent	*Percent*	*Percent*	*Percent*	*Percent*
1941	79,941,240	51.83	0.085	8.18	0.78	11.01
1942	92,069,902	51.65	.089	8.21	.79	10.98
1943	85,116,347	51.58	.091	8.32	.82	11.06
1944	81,039,404	51.72	.088	8.42	.74	11.02
1945	75,206,781	51.01	.088	8.41	.70	10.82

Stocks at Lake Erie ports.—On December 1, 1945, just before navigation stopped, the Lake Superior Iron Ore Association reported 4,814,991 tons of iron ore at Lake Erie ports compared with 5,472,556 tons in 1944. At the opening of the 1946 season (May 1, 1946), 3,019,184 tons of ore were in stock at these ports compared with 1,959,675 tons on May 1, 1945. Withdrawals from stocks during this 5-month period in 1945–46 were only about one-half that of a year ago.

Prices of Lake Superior ore.—Amendment 2 to Office of Price Administration Revised Maximum Price Regulation 113, effective December 29, 1945, granted price increases for Lake Superior iron ore ranging from 10 to 20 cents per gross ton. The increases were effective for the entire 1945 shipping season under an order issued a year before, which allowed the industry to quote prices subject to adjustments allowed by OPA. The price agency found from its studies that underground mining operations, which supply the bulk of the merchant ore, were being carried on at a loss. Consequently, greater increases were allowed the underground mines. The increases apply only to ore shipped for sale, or to about 19,000,000 tons in 1945. The new ceiling prices per gross ton for standard (51.50 percent iron) iron ores and the amount of increases were as follows: Mesabi Non-Bessemer, \$4.55, an increase of 10 cents; Mesabi Bessemer, \$4.70, an increase of 10 cents; Old Range Non-Bessemer, \$4.80, an increase of 20 cents; Old Range Bessemer, \$4.95, an increase of 20 cents; High Phosphorus, \$4.55, an increase of 20 cents. Prices of manganiferous, siliceous, and lump ores were increased 20 cents.

Reserves.—The following tables showing reserves of iron ore in Michigan and Minnesota were compiled by the Michigan Department of Conservation and the Minnesota Department of Taxation, respectively. It should be borne in mind that these data represent only taxable and State-owned reserves and do not represent the total that

Iron-ore reserves in Michigan, January 1, 1942–46, in gross tons

Range	1942	1943	1944	1945	1946
Gogebic	30, 073, 528	32, 901, 951	32, 791, 848	32, 686, 550	31, 828, 392
Marquette	48, 306, 120	50, 991, 701	49, 652, 024	51, 357, 761	51, 648, 430
Menominee	56, 130, 084	55, 563, 724	53, 902, 631	50, 376, 403	48, 260, 784
	134, 509, 732	139, 457, 376	136, 346, 503	134, 420, 714	131, 737, 606

Unmined iron-ore reserves in Minnesota, May 1, 1940–45, in gross tons

	1940	1941	1942	1943	1944	1945
Mesabi	1, 122, 593, 116	1, 097, 000, 026	1, 069, 752, 650	1, 043, 804, 378	1, 020, 138, 504	962, 290, 748
Vermilion	13, 208, 699	14, 018, 934	14, 903, 353	13, 449, 980	12, 636, 820	12, 349, 903
Cuyuna	65, 026, 280	65, 012, 265	64, 411, 762	63, 559, 455	62, 059, 815	59, 659, 027
Total Minnesota (Lake Superior district)	1, 200. 828, 095	1, 176, 031, 225	1, 149, 067, 765	1, 120, 813, 813	1, 094, 835, 139	1, 034, 299, 678
Filmore County			250, 000	259, 859	231, 393	
State ore (not taxable)	21, 376, 816	19, 304, 808	31, 978, 475	16, 672, 818	13, 000, 996	19, 865, 715
	1, 222, 204, 911	1, 195, 336, 033	1, 181, 296, 240	1, 137, 746, 490	1, 108, 067, 528	1, 054, 165, 393

may be expected to become available. Pehrson [2] has shown that 33 percent of the United States reserves of commercial ore, or about 1.8 billion tons, occurs in the Lake Superior district.

MINING BY STATES

Alabama.—Production of crude ore in Alabama, the third largest producing State, dropped 18 percent in 1945 from 1944. Output of brown ore, all from open-pit operations, decreased 28 percent and that of hematite, all from underground mines, declined 12 percent. Ninety percent of the brown ore came from mines in Franklin, Colbert, Tuscaloosa, and Bibb Counties. The hematite was produced at the Red Mountain group, Sloss-Sheffield's Sloss Nos. 1 and 2 mines, and the Spaulding mine of Republic Steel Corp. All hematite was from Jefferson County.

Tennessee Coal, Iron & Railroad Co.'s Red Mountain group produced hematite, some of which was sintered before consumption and the rest crushed and blended and shipped direct to furnaces. Sinter was also produced at the Spaulding mine. Hematite from this mine was concentrated and mixed with pyrites cinder from Virginia and other materials before being sintered. Sinter produced from materials other than iron ore has been excluded from Alabama mine statistics but has been credited to sinter production at consuming plants. A process for concentrating Alabama red ore by flotation is described by Clemmer and others.[3]

Labor shortages in Alabama were responsible for the decline in mine output, and local supplies had to be supplemented during the year by shipments of 115,474 gross tons of Lake Superior ore from stocks at Gary, Ind. Twenty-one mines were active in Alabama in 1945 compared with 28 in 1944 and 52 in 1943.

California.—Production of crude ore in California fell to 280,573 gross tons in 1945 from 845,260 tons in 1944. This sharp drop is attributed to a substantial shift of Kaiser Steel Co.'s source of iron ore from its Vulcan mine in San Bernardino County to the Walker Iron Mining Co. operation in southwestern Utah. Although one-half, or 141,823 tons, of California's 1945 output was from the Vulcan, this mine in 1944 produced 695,233 tons. The hematite ore in 1945 averaged 52.04 percent Fe (natural) and was shipped directly to the blast furnace at Fontana. Aside from the output of the Vulcan mine, Santa Cruz and Shasta Counties produced 138,750 tons of magnetite, all of which was beneficiated by table concentration, crushing, and washing. The 66,786 tons of concentrate recovered together with 488 tons from stock comprised the 67,274 tons of magnetite shipped for use as ship ballast. Ballast ore is usually graded according to specific gravity.

Colorado.—The Bruce mine at Leadville, Lake County, carried on exploration work during the last 2 months of 1945 and shipped 117 tons of hematite to blast furnaces at Pueblo. The mine is operated by Stiron Metals, Ltd.

[2] Pehrson, Elmer W., The Mineral Position of the United States and the Outlook of the Future: Min. and Met., vol. 26, No. 460, April 1945, p. 209.

[3] Clemer, J. Bruce, Clemmons, B. H., Rampacek, Carl, Williams, M. F., Jr., and Stacy, R. H., Beneficiation of Iron Ores by Flotation: Bureau of Mines Rept. of Investigations 3799, 1945, 42 pp.

Georgia.—The output of Georgia totaled 1,352,050 gross tons of crude ore—4 percent less than in 1944. After washing, 276,050 tons were recovered and shipped for use in making pig iron and steel. Georgia's output consisted entirely of brown ore mined by open-pit methods and was centered in Bartow, Polk, and Whitfield Counties. The Hodge Mining operation in Bartow County was the largest in the State.

Michigan and Minnesota.—See Review of Lake Superior District.

Missouri.—Production of crude ore in Missouri rose from 19,282 gross tons in 1944 to 257,591 tons in 1945. This large increase was brought about by the reopened (December 1944) Iron Mountain mine of the M. A. Hanna Co. in St. Francois County. After crushing and jigging, the hematite from this pit averaged 54.86 percent Fe (natural). A small tonnage of brown ore was produced at various mines by Chapman, Doane & Ives.

Nevada.—With the drop in demand for ballast by West coast shipyards, production of magnetite in Nevada dropped from 36,581 gross tons in 1944 to 6,196 tons in 1945. All of the ore was mined in Pershing County, mostly by Segerstrom and Heizer; 54 percent was for ballast, 45 percent for metallurgical purposes, and 1 percent for cement.

New Jersey.—The output of crude ore from New Jersey mines totaled 855,470 gross tons in 1945, 21 percent less than in 1944. All came from underground mines in Morris and Warren Counties; some was shipped directly to consumers, but most was concentrated magnetically. The Alan Wood Steel Co., largest producer, operated the Scrub Oaks mine in Morris County and the Washington mine in Warren County. The Warren Foundry & Pipe Co. operated the Mount Hope mine and the Richard Ore Co. the Richard mine; both are in Morris County.

New Mexico.—The St. Louis Smelting & Refining Co. El Paso iron claim at Hanover, Grant County, shipping magnetite, supplied the State total of 369 tons in 1945.

New York.—Crude magnetite was produced from six mines in the Adirondack district in 1945. The Benson mine of the Jones & Laughlin Ore Co. in St. Lawrence County was the largest producer of crude ore in New York; a total of 1,558,457 tons was mined during the year compared with 984,020 tons in 1944. The MacIntyre mine of National Lead Co. was the second largest producer followed by Republic Steel Co. New Bed-Harmony-Old Bed mine, which was first in 1944. All the ore from the three mines was concentrated and sintered except the lump ore from Republic's mine, which was shipped directly to furnaces.

The hematite produced in New York came from the mine of Clifton Metallic Paint Co. in Oneida County.

Pennsylvania.—Except for the small tonnage of carbonate and brown ore from Carbon and Centre Counties, respectively, the entire output consisted of magnetite from the Cornwall mine in Lebanon County. Ore from Cornwall is shipped to Lebanon, where it is concentrated magnetically and treated further by flotation to remove chalcopyrite, pyrite, and other minerals. Some magnetite concentrates are sintered, and some are shipped to consuming plants for sintering.

The Prince Manufacturing Co. mined carbonate ore from the Hazard and Little Gap mine, and the small tonnage of brown ore was produced by the Scotia Mining Co., which concluded its operation of the Scotia mine on June 18.

South Dakota.—Paint ore was produced at the Rochford mine, formerly Iron Lode, by the Lor Mining Co. which took over the operation from John Lessering on May 1, 1945.

Texas.—Brown ore was mined at the Lone Star Steel Co. Lone Star mine in Morris County and was shipped to furnaces at Birmingham and Gadsden, Ala. At the end of 1945, the Lone Star's blast furnace at Daingerfield had not yet been blown in. Sheffield Steel Co. North Basin and Mount Haven mines, in Cass and Cherokee Counties,

Iron ore mined in the United States in 1945, by States and counties, in gross tons

[Exclusive of ore containing 5 percent or more manganese]

State and county	Active mines	Crude ore	Usable ore
Alabama:			
Bibb	1	150,000	30,357
Blount	1	50,000	10,322
Butler	1	19,000	3,808
Cherokee	[1] 3	83,500	16,695
Chilton	1	1,700	344
Colbert	1	610,314	63,972
Franklin	4	1,121,996	207,081
Jefferson	8	5,799,605	5,631,850
Tuscaloosa	1	420,000	84,133
	[1] 21	8,256,115	6,048,562
California:			
San Bernardino	1	141,823	141,823
Santa Cruz	1	18,750	6,250
Shasta	1	120,000	60,536
	3	280,573	208,609
Colorado: Lake	1	117	117
Georgia:			
Bartlow	[1] 1	836,300	166,996
Polk	[1] 3	515,600	109,023
Whitfield	1	150	31
	[1] 5	1,352,050	276,050
Michigan:			
Dickinson	3	597,783	597,783
Gogebic	7	3,027,438	3,027,438
Iron	16	3,575,587	3,542,456
Marquette	16	4,664,816	4,664,816
	42	11,865,624	11,832,493
Minnesota:			
Crow Wing	12	2,076,424	1,784,010
Itasca [2]	31	21,627,305	12,486,443
St. Louis	52	48,514,124	47,349,884
	95	72,217,853	61,620,337
Missouri:			
St. Francois	1	253,591	109,330
Various counties	[1] 1	4,000	4,000
	[1] 2	257,591	113,330
Nevada: Pershing	2	6,196	6,196
New Jersey:			
Morris	3	855,470	430,308
Warren	1		
	4	855,470	430,308
New Mexico: Grant	1	369	369
Virginia: Pulaski	1		
New York:			
Clinton	1		
Essex	3		
Oneida	1	6,838,497	3,194,669
St. Lawrence	2		
Pennsylvania:			
Lebanon	1		
Centre	1		
Carbon	1	799	545
	11	6,839,296	3,195,214
South Dakota: Pennington	1	4,162	4,162
Texas:			
Cass	1		
Cherokee	1	471,014	217,237
Llano	1		
Morris	1		
	4	471,014	217,237
Utah: Iron	4	1,931,749	1,931,749
Wisconsin: Iron	2	1,368,215	1,368,215
Wyoming: Platte	1	606,005	606,005
	[1] 199	106,312,399	87,858,953

[1] In addition, there is an undetermined number of small pits. The output of these pits is included in the tonnage given.

[2] Includes output from 1 plant reprocessing tailings.

produced brown ore in 1945 for use at its blast furnace at Houston.

Hematite was mined and shipped by Tillie B. Moss from the Iron Mountain mine in Llano County.

Utah.—The iron ore mined in Utah in 1945 was semi-altered magnetite from open-pit mines in Iron County. The active mines during the year were the Iron Mountain, Duncan, Walker Iron Mining Co., and Great Western.

The Iron Mountain mine, operated by the Columbia Iron Mining Co., supplied the ore for blast and steel furnaces at Geneva and Provo, Utah; the Duncan mine of the Colorado Fuel & Iron Corp. shipped ore to the blast furnaces at Pueblo, Colo.; and the Walker Iron Mining Co. shipped to the Kaiser Co. plant at Fontana, Calif. Iron ore from the Great Western mine, operated by Helene E. Beatty, was shipped to steel furnaces in the San Francisco area.

Virginia.—In 1945, as in 1944, the only output from Virginia consisted of brown ore produced at the American Pigment Co. mine at Hiwassee, Pulaski County. The ore was hand picked at the mine and washed at the mill before being used as pigment.

Wisconsin.—See Review of Lake Superior District.

Wyoming.—Hematite for Pueblo (Colo.) furnaces was mined at the Sunrise mine in Platte County by the Colorado Fuel & Iron Corp. during 1945.

EMPLOYMENT AT IRON MINES

Complete data on employment at iron mines in 1945 are not yet available. Preliminary figures indicate an 8-percent decline in the number of workers from 1944. The average number employed is estimated at 26,900 men working 61,650,000 man-hours to produce 89,056,050 gross tons of ore—an average of 1.44 tons per man-hour, virtually unchanged from 1944. The above data and the table that follows include manganiferous ore in the Lake Superior district, which is treated by the trade as a special grade of iron ore.

Employment at iron-ore mines and beneficiating plants, quantity and tenor of ore produced, and average output per man in 1944, by districts and States [1]

District and State	Employment: Average number of men employed	Employment: Time employed: Average number of days	Employment: Time employed: Total man-shifts	Employment: Time employed: Man-hours: Average per shift	Employment: Time employed: Man-hours: Total	Production: Crude ore (gross tons)	Production: Usable ore: Gross tons	Production: Usable ore: Iron contained: Gross tons	Production: Usable ore: Iron contained: Percent natural	Average per man (gross ton): Crude ore: Per shift	Average per man (gross ton): Crude ore: Per hour	Average per man (gross ton): Usable ore: Per shift	Average per man (gross ton): Usable ore: Per hour	Average per man (gross ton): Usable ore: Iron contained: Per shift	Average per man (gross ton): Usable ore: Iron contained: Per hour
Lake Superior:															
Michigan	8, 267	269	2, 224, 791	8.0	17, 799, 415	12, 867, 134	12, 867, 134	6, 652, 104	51. 70	6. 416	0. 802	6. 416	0. 802	3. 323	0. 415
Wisconsin						1, 406, 985	1, 406, 985	740, 661	52. 64						
Minnesota	11, 715	273	3, 199, 914	8.0	25, 641, 380	75, 254, 857	65, 966, 581	33, 794, 728	51. 23	23. 518	2. 935	20. 615	2. 573	10. 561	1. 318
	19, 982	271	5, 424, 705	8.0	43, 440, 795	89, 528, 976	80, 240, 700	41, 187, 493	51. 33	16. 504	2. 061	14. 792	1. 847	7. 593	. 948
Southeastern States:															
Alabama	5, 191	298	1, 545, 224	8. 1	12, 482, 059	10, 048, 118	6, 829, 437	2, 471, 197	36. 18	6. 503	. 805	4. 420	. 547	1. 599	. 198
Georgia	117	231	27, 030	10. 1	273, 830	1, 414, 990	285, 523	132, 653	46. 46	52. 593	5. 191	10. 812	1. 067	5. 000	. 494
Virginia						6, 592	6, 716	2, 502	37. 25						
	5, 308	296	1, 572, 254	8. 1	12, 755, 889	11, 469, 700	7, 121, 676	2, 606, 352	36. 60	7. 295	. 899	4. 530	. 558	1. 658	. 204
Northeastern States:															
New Jersey	691	300	207, 296	8. 0	1, 661, 144	1, 087, 948	499, 732	312, 513	62. 54	5. 248	. 655	2. 411	. 301	1. 508	. 188
New York	2, 571	304	782, 736	8. 0	6, 299, 475	6, 661, 593	3, 349, 664	2, 062, 526	64. 19	8. 511	1. 057	4. 279	. 532	2. 635	. 327
Pennsylvania									56. 33						
	3, 262	304	990, 032	8. 0	7, 960, 619	7, 749, 541	3, 849, 396	2, 375, 039	61. 70	7. 828	. 973	3. 888	. 484	2. 399	. 298
Western States:															
Arkansas	377	253	95, 337	8. 0	765, 145	76	76	49	64. 47	8. 165	1. 017	8. 165	1. 017	4. 412	. 550
Missouri						19, 282	19, 282	10, 430	54. 09						
Nevada						36, 581	36, 581	23, 443	64. 09						
Washington						8, 695	8, 695	2, 418	27, 81						
Wyoming						713, 759	713, 759	384, 288	53. 84						
New Mexico	59	272	16, 059	7. 9	127, 504	33, 460	33, 460	18, 791	56. 16	21. 214	2. 672	19. 461	2. 451	9. 247	1. 165
South Dakota						1, 038	1, 038	415	40. 00						
Texas						306, 185	278, 034	129, 292	46. 50						
California	119	287	34, 155	7. 6	260, 247	845, 260	809, 196	432, 659	53. 47	24. 748	3. 248	23. 692	3. 109	12. 668	1. 662
Utah	137	308	42, 160	7. 8	329, 331	1, 542, 284	1, 542, 284	810, 927	52. 58	36. 582	4. 683	36. 582	4. 683	19. 235	2. 462
	692	271	187, 711	7. 9	1, 482, 227	3, 506, 620	3, 442, 405	1, 812, 712	52. 66	18. 681	2. 366	18. 339	2. 322	9. 657	1. 223
Total	29, 244	280	8, 174, 702	8. 0	65, 639, 530	112, 254, 837	94, 654, 177	47, 981, 596	50. 69	13. 732	1. 710	11. 579	1. 442	5. 870	. 731

[1] Manganiferous ore included with Michigan and Minnesota

WORLD PRODUCTION

The following table lists world iron-ore production by countries, insofar as data are available:

World production of iron ore, 1939–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943	1944	1945
North America:							
Canada	117, 583	376, 120	468, 138	494, 691	581, 769	501, 899	1, 029, 475
Cuba	166, 739	160, 339	192, 851	132, 847	47, 113	28, 370	----------
Mexico	143, 873	110, 783	110, 134	130, 822	168, 148	186, 961	175, 165
Newfoundland	1, 679, 625	1, 532, 990	981, 735	1, 209, 228	551, 515	471, 824	1, 000, 449
United States	52, 562, 024	74, 878, 718	93, 892, 753	107, 219, 890	102, 872, 863	95, 628, 294	89, 794, 834
South America:							
Argentina	3, 588	2, 500	3, 750	890	150	----------	----------
Brazil (exports)	396, 938	255, 548	420, 756	308, 921	322, 802	205, 798	299, 994
Chile [2]	1, 626, 490	1, 749, 840	1, 702, 692	408, 587	299, 411	674, 529	944, 863
Europe:							
Belgium	174, 470	78, 850	131, 190	112, 800	127, 400	(3)	(3)
Bulgaria	20, 115	30, 000	(3)	(3)	(3)	(3)	(3)
Czechoslovakia [4]	1. 432, 000	1, 574, 000	1, 687, 000	1, 575, 000	(3)	(3)	(3)
France	(5)	12, 731, 070	10, 570, 450	12, 757, 620	16, 879, 160	9, 265, 290	7, 824, 136
Germany [6]	12, 046, 673	16, 208, 989	15, 455, 698	13, 223, 456	(3)	(3)	(3)
Austria	2, 943, 679	3, 127, 127	2, 523, 036	2, 617, 605	(3)	(3)	(3)
Greece	307, 284	(3)	(3)	(3)	(3)	(3)	(3)
Hungary	370, 000	(3)	(3)	(3)	(3)	(3)	(3)
Italy	947, 994	1, 179, 422	1, 340, 410	1, 085, 000	(3)	(3)	49, 256
Luxemburg	(5)	(3)	6, 950, 391	5, 107, 063	(3)	(3)	(3)
Norway	1, 340, 408	615, 448	566, 513	284, 498	219, 000	264, 426	(3)
Poland	[7] 1, 000, 000	(3)	(3)	(3)	(3)	(3)	(3)
Portugal	418	301	287	18	----------	(3)	(3)
Rumania	131, 992	(3)	(3)	150, 570	(3)	(3)	(3)
Spain	2, 556, 089	2, 012, 238	1, 718, 979	1, 606, 161	1, 587, 817	1, 508, 610	1, 156, 924
Sweden	13, 787, 202	11, 294, 998	10, 527, 889	(3)	(3)	(3)	(3)
Switzerland	[8] 171, 279	200, 000	313, 803	316, 767	285, 798	214, 500	18, 860
U. S. S. R. [9]	(5)	27, 500, 000	22, 742, 110	(3)	(3)	(3)	(3)
United Kingdom: Great Britain [10]	14, 721, 446	18, 170, 539	19, 120, 129	19, 581, 271	18, 658, 952	15, 139, 457	[7] 14, 000, 000
Yugoslavia	666, 816	[7 11] 553, 926	[7 11] 523, 000	(3)	(3)	(3)	(3)
Asia:							
Burma	26, 680	(3)	(3)	(3)	(3)	(3)	(3)
India, British	3, 166, 087	3, 153, 165	3, 245, 749	3, 269, 070	2, 697, 789	(3)	(3)
Indochina	134, 691	32, 442	(3)	(3)	(3)	(3)	(3)
Japan	(5)	(3)	(3)	(3)	(3)	(3)	(3)
Korea (Chosen)	1, 021, 000	1, 072, 000	1, 691, 000	2, 278, 000	2, 359, 000	3, 387, 000	(3)

See footnotes at end of table.

World production of iron ore, 1939–45, by countries, in metric tons [1]—Continued

Country [1]	1939	1940	1941	1942	1943	1944	1945
Asia—Continued							
Malay States:							
Federated	780	972	(3)	(3)	(3)	(3)	(3)
Unfederated	1,991,173	1,872,903	(3)	(3)	(3)	(3)	(3)
Manchuria	(5)	(3)	[7] 4,000,000	(3)	(3)	(3)	(3)
Philippine Islands (exports)	1,154,738	1,191,641	[12] 852,080	(3)	(3)	(3)	(3)
Turkey	143,277	130,338	60,793	19,044	91,751	90,430	125,000
U. S. S. R.	(9)	(9)	(9)	(3)	(3)	(3)	(3)
Africa:							
Algeria	2,940,280	1,609,740	317,019	306,549	183,572	787,768	(3)
Belgian Congo	(5)	6,100	13,000	9,000	23,964		
Morocco:							
French	420,728	75,233	3,001	3,329	8,967	5,114	(3)
Spanish	[8] 1,038,205	614,371	554,776	547,432	547,625	690,880	750,167
Northern Rhodesia	138	271	271	394	624	212	(3)
Sierra Leone	(5)	(3)	[8] 1,046,501	[8] 643,241	517,727	641,165	(3)
South-West Africa	19,500	(3)	(3)	(3)	(3)	(3)	(3)
Tunisia	764,731	343,562	1,047	30,994	29,703	88,080	(3)
Union of South Africa	490,136	638,757	812,700	717,738	738,128	768,392	866,107
Oceania:							
Australia:							
New South Wales	(5)	(3)	64,115	185,041	205,691	154,326	(3)
Queensland	4,003	2,887	2,349	3,815	3,095	3,474	(3)
South Australia	2,613,036	2,350,484	2,276,345	2,156,111	2,217,865	2,061,810	(3)
Tasmania		1,186	2,215		7		
New Caledonia	83,567	176,600	99,181			60,406	
New Zealand	1,611	1,208	1,569	2,472	5,068	6,133	(3)
	204,000,000	[7] 212,000,000	[7] 233,000,000	[7] 245,000,000	(3)	(3)	(3)

[1] In addition to the countries listed China, Egypt, Eritrea, Finland, French West Africa, and Madagascar report production of iron ore, but complete data are not available.
[2] Production of Tofo mines. [3] Data not available. [4] Bohemia, Moravia, and Slovakia. [5] Estimate included in total.
[6] Exclusive of manganiferous iron ore carrying 12 to 30 percent manganese. [7] Estimate. [8] Exports.
[9] U. S. S. R. in Asia included with U. S. S. R. in Europe.
[10] Exclusive of bog ore, which is used mainly for purification of gas. [11] Croatia only.
[12] January to July, inclusive.

REVIEW BY COUNTRIES

Algeria.—The Ouenza-Boukadra group of mines, which normally supplies two-thirds of the iron-ore output of Algeria, was virtually the only producer in 1945. The other producers are the Zaccar, Dj Bou, Amorane, and Tinezrit. Shipments of ballast ore from the Kelousha-Beni Saf mines dropped sharply in the second quarter of 1945.

Canada.—The new ore dock at Port Arthur, Ontario, opened July 21, 1945, when the steamship *Marquette* took out 7,300 tons of Steep Rock ore. The docks have a storage capacity of 30,000 tons and an annual loading capacity of 2,000,000 tons.

Steep Rock mine shipped a total of 505,375 gross tons of iron ore in 1945, and the Helen mine in the Michipicoten range shipped 513,804 tons. Most of this is exported to the United States; receipts of Canadian ore (including some pyrites cinder) totaled 704,225 gross tons. However, Canada is largely dependent upon United States ore and in 1945 imported 2,062,992 tons.

Colombia.—Wide interest is being shown in plans of the Colombian Government to organize a domestic iron and steel industry, using the iron-ore deposits at Paz del Rio on the Chicamoch River. The Instituto de Fomento Industrial has a 30-year concession to exploit the ore on the west side of the river. Reserves are reported to be 50 million tons of iron ore ranging from 38 percent to 50 percent Fe, 6 to 20 percent SiO_2, 1 percent P, 6 percent Al_2O_3, and less than 0.2 percent S. The ore occurs at depths requiring underground mining methods. The steel plant is to be constructed at Belencito.

Chile.—Chilean output of iron ore in 1945 was hematite supplied by the Tofo mine in Coquimbo Province. This ore, which averaged (natural) 62.99 percent Fe, was shipped to local blast furnaces at Corral near Valdivia and to the United States. Production totaled 929,945 gross tons and shipments amounted to 234,305 tons. United States imports from Chile totaled 214,670 tons.

Cuba.—Except for a small experimental production (302 gross tons) from the Mayari mine in Oriente Province, there was no output in Cuba during 1945.

Iron ore shipped from mines in the Province of Oriente, Cuba, 1884–1945 in gross tons

	Juragua, Daiquiri, and Estancia (hematite and magnetite)	Sigua (hematite)	Mayari (brown ore)	Guama (hematite)	El Cuero (hematite)	Total
1884–1943	22,503,074	20,438	3,988,694	41,241	903,103	27,456,550
1944			96			96
1945			302			302
	22,503,074	20,438	3,989,092	41,241	903,103	27,456,948

PIG IRON, FERRO-ALLOYS, AND STEEL

By NORWOOD B. MELCHER AND JOHN HOZIK [1]

SUMMARY OUTLINE

GENERAL SUMMARY

Successive cut-backs in steel requirements following VE-day resulted in an 11-percent decrease in production of ingots and castings during 1945. The operating rate dropped from 92 percent of capacity in May to 87 percent in June; after July the monthly operating rate did not exceed 80 percent, and consequently only 46 percent of the 1945 total was produced during the last 6 months. Output of steel ingots and castings totaled 79,701,648 net tons compared with 89,641,600 tons in 1944. Delays in steel deliveries began in January, when heavy snows forced transportation to a virtual standstill, and persisted throughout 1945. Following this, orders were placed for war materials in preparation for the 1945 offensives. This new demand resulted in efforts by the War Production Board to direct steel into arms production, and deliveries of much Controlled Materials Plan tonnage were held up. In March, United Nations military successes in Europe resulted in cut-backs in orders for war material, which delayed further deliveries of steel products. A Navy program for construction of 84 combat ships was reduced to 12, which adversely affected steel rolling in April. In the same month the shell program was reduced 10 percent, and reductions in merchant shipbuilding released 120,000 tons of plates and 40,000 tons of shapes. Order cancellations continued through June and July, and steel production dropped to 60 percent of capacity during the week following Japan's capitulation in August. Civilian demands caused steel production to rise during the closing months, but not to the wartime rate. The

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Controlled Materials Plan, which proved successful in expediting war production for many months, was made ineffective on September 30, 1945. A plan for voluntary rationing was begun by steel producers late in the year.

Salient statistics of pig iron, ferro-alloys, and steel in the United States, 1944–45

	1944		1945	
	Net tons	Value	Net tons	Value
Pig iron:				
Production	61,003,759	[1]	53,224,213	[1]
Shipments	60,995,977	$1,278,981,313	53,265,353	$1,172,435,165
Average value per ton at furnace		20.97		22.01
Imports	5,778	116,408	21,433	440,283
Exports	162,478	4,307,389	90,968	2,396,175
Ferro-alloys:				
Production	1,893,855	[1]	1,732,423	[1]
Shipments:				
Ferromanganese	715,059	91,406,229	610,376	78,907,189
Spiegeleisen	155,325	4,851,490	157,774	5,108,144
Ferrosilicon	686,895	39,531,552	615,596	34,968,350
Other ferro-alloys	303,677	110,224,768	277,911	91,525,974
	1,860,956	246,014,039	1,661,657	210,509,657
Imports:				
Ferromanganese	4,199	394,641	35,521	3,733,846
Spiegeleisen	3,761	153,032	3,146	142,883
Ferrosilicon	22,646	750,153	23,067	936,006
Steel:				
Production:				
Open-hearth:				
Basic	79,168,294		71,069,876	
Acid	1,195,659		869,726	
Bessemer	5,039,923	[1]	4,305,318	[1]
Crucible	25		24	
Electric	4,237,699		3,456,704	
	89,641,600	[1]	79,701,648	[1]
Shipments to consuming industry	60,352,690	[1]	57,242,240	[1]

[1] Data not available.

Shipments of steel products to consuming industries declined from 60,352,690 net tons in 1944 to 57,242,240 tons in 1945. This decline was more than explained by a drop in deliveries to the shipbuilding industry. This industry reached enormous proportions during the war; and in 1943, a total of 1,896 ships were launched, representing a deadweight tonnage of 19,000,000 tons. In 1944, the industry used 10,287,299 tons of steel and was still the largest consumer, but in 1945 shipments dropped to 2,719,415 tons. Of the latter quantity, naval vessels used 1,169,367 tons and commercial vessels 1,550,048 tons. At the close of 1945, shipyards were considering conversion to peacetime products, including freight cars, oil-refinery fabrication work, and prefabricated houses. Railroads did not show the upsurge in construction and rehabilitation that was expected to follow the close of World War II. Deliveries to that industry declined from 5,424,798 tons in 1944 to 5,121,197 tons in 1945. Containers used 17 percent more steel than in 1944, and the construction industry used 5 percent more. Although the potential requirements of the automobile industry are very large, there was no substantial increase in receipts of steel in 1945.

Pig iron continued under specific ceiling prices during 1945, but two increases were granted during the year—the first since prices were frozen at the late 1940 level by the Office of Price Administration. An increase of $1 per gross ton was made effective February 14, 1945, and a second increase of $0.75 on all grades except charcoal became effective on October 23. Interim price increases on fine steel products became effective January 11, 1945. Hot-rolled carbon plates and sheets advanced $2 per ton, galvanized sheets and steel rails $3 per ton, and nails and staples other than galvanized $5 per ton. Effective May 23, further increases were announced, which applied to the schedule of April 16, 1941, and included the interim prices of January 1945. Carbon semifinished steel advanced $2 per ton; carbon steel

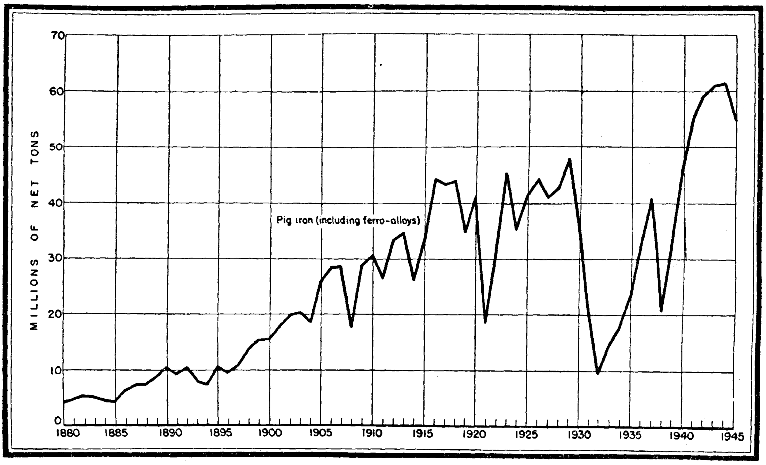

FIGURE 1.—Trend in production of pig iron in the United States, 1880–1945.

tube rounds and billets, $4; carbon plates, $3; rails, except light, $3; light rails, $5; tin plate, $3 per net ton; carbon hot-rolled bars and bar shapes, $2 per gross ton; carbon wire rods, $3; carbon manufacturers' and merchants' wire, $3; nails and staples, except galvanized, $7; twisted barbless and barbed wire, $2; bail ties, $7; hot-rolled sheets, $2; galvanized sheets, $2; and track spikes, $5. On August 6 a further increase of $2 per ton on cold-finished bars became effective.

PIG IRON

PRODUCTION AND SHIPMENTS

Domestic production of pig iron in 1945, exclusive of ferro-alloys, decreased 13 percent from the record year 1944. Output comprised 53,176,388 net tons using coke and 47,825 using charcoal as fuel. Pennsylvania continued its position as the largest producer of pig iron in 1945, with 30 percent of the total; Ohio ranked second with 21 percent.

Pig iron produced and shipped in the United States, 1944–45, by States

State	Produced		Shipped from furnaces			
	1944	1945	1944		1945	
	Net tons	Net tons	Net tons	Value	Net tons	Value
Alabama	3,949,172	3,581,993	3,936,471	$68,239,438	3,588,863	$65,991,229
California	353,682	327,244	384,528	33,192,725	313,883	31,051,220
Colorado, Utah	1,363,998	1,314,081	1,358,949		1,279,153	
Illinois	5,685,533	5,045,609	5,686,397	118,953,078	5,061,368	116,303,897
Indiana	6,850,642	5,981,717	6,857,453	153,676,643	5,981,937	138,253,310
Kentucky	728,588	631,105	728,588	(1)	631,105	(1)
Maryland	2,515,049	2,246,941	2,514,735	(1)	2,244,964	(1)
Massachusetts	(1)		(1)	(1)	(1)	(1)
Michigan	1,621,979	1,454,131	1,617,912	(1)	1,482,037	26,079,628
Minnesota	571,185	466,758	565,775	(1)	465,314	(1)
New York	3,832,192	3,294,724	3,836,078	76,575,005	3,278,345	74,857,092
Ohio	13,373,397	11,258,960	13,400,053	294,265,267	11,264,024	258,959,815
Pennsylvania	18,507,068	16,172,296	18,503,427	397,395,665	16,168,496	361,684,919
Tennessee	(1)	(1)	(1)	(1)	(1)	(1)
Texas	150,015	(1)	137,566	(1)	147,247	(1)
Virginia			(1)	(1)	(1)	(1)
West Virginia	1,355,333	1,272,148	1,355,784	(1)	1,265,346	(1)
Undistributed [2]	145,926	176,506	112,261	136,683,492	93,271	99,254,055
	61,003,759	53,224,213	60,995,977	1,278,981,313	53,265,353	1,172,435,165

[1] Included under "Undistributed."
[2] Includes statistics for States entered as "(1)."

Shipments of pig iron decreased 13 percent in quantity from 1944, but only 8 percent in value. The values given in the following table represent the approximate amounts received for the iron f. o. b. furnaces and do not include freight costs, selling commissions, and other items normally included in market prices for pig iron published by trade journals.

Pig iron shipped from blast furnaces in the United States, 1944–45, by grades

Grade	1944			1945		
	Net tons	Value		Net tons	Value	
		Total	Average		Total	Average
Charcoal	55,705	$1,652,378	$29.66	52,263	(1)	(1)
Foundry	2,405,222	48,134,381	20.01	2,238,013	$46,296,846	$20.69
Basic	46,289,976	953,105,181	20.59	40,332,690	873,657,477	21.66
Bessemer	9,278,387	207,628,157	22.38	7,735,489	180,911,470	23.39
Low-phosphorus	486,362	13,089,619	26.91	307,792	8,697,437	28.26
Malleable	2,145,823	48,915,065	22.80	2,356,250	55,798,845	23.68
All other (not ferro-alloys)	334,502	6,456,532	19.30	242,856	7,073,090	23.97
	60,995,977	1,278,981,313	20.97	53,265,353	1,172,435,165	22.01

[1] Value included with "All other."

The number of furnaces in blast June 30 and December 31 and the total number of furnaces recorded for 1944 and 1945 follow:

Blast furnaces (including ferro-alloy blast furnaces) in the United States, 1944–45 [1]

State	In blast June 30, 1944	Dec. 31, 1944			In blast June 30, 1945	Dec. 31, 1945		
		In	Out	Total		In	Out	Total
Alabama	19	19	1	20	19	17	3	20
California	1	1		1	1	1		1
Colorado	3	3	1	4	3	3	1	4
Illinois	19	20	2	22	19	18	4	22
Indiana	20	19	1	20	18	18	2	20
Kentucky	3	3		3	3	3		3
Maryland	7	7		7	6	6	1	7
Massachusetts	1		1	1			1	1
Michigan	5	6		6	5	5		5
Minnesota	3	3		3	2	2	1	3
New York	15	14	3	17	14	13	4	17
Ohio	48	44	3	47	43	42	5	47
Pennsylvania	69	67	9	76	70	65	11	76
Tennessee	2	2	2	4	2	2	1	3
Texas	1	1	1	2	1		2	2
Utah	3	4	1	5	3	2	3	5
Virginia	1	1		1	1		1	1
West Virginia	4	4		4	4	4		4
	224	218	25	243	214	201	40	241

[1] American Iron and Steel Institute.

CONSUMPTION OF METALLIFEROUS MATERIALS

The production of pig iron in 1945 required 95,128,548 tons of iron ore, sinter, and manganiferous iron ore, 3,228,516 tons of mill cinder and roll scale, 3,450,162 tons of open-hearth and Bessemer slag, 2,049,140 tons of purchased scrap, and 62,661 tons of miscellaneous material, an average of 1.952 tons of metalliferous materials (exclusive of home scrap and flue dust) per ton of pig iron made.

Of the pig iron manufactured in 1945, it is calculated that 179,587 tons valued at $3,859,947 were made from 338,014 tons of foreign ores, including ore from Africa, Canada, Chile, Cuba, and Mexico, indicating an average yield of 53.13 percent from imported ore. Domestic ore and sinter (94,790,534 tons) and other materials (8,790,479 tons) totaling 103,581,013 tons were reported as used in the manufacture of 53,044,626 tons of pig iron, indicating an average pig-iron yield of 51.21 percent from domestic materials. In addition, 1,289,537 tons of home scrap and 98,934 tons of flue dust were consumed in making pig iron in 1945.

Alabama furnaces used red hematite from Jefferson County, Ala., and the Lake Superior district, brown ore from Alabama and Georgia, and sintered brown ore from Texas. Manganese-bearing ores of domestic and Mexican origin were also used. Because of the preponderance of relatively low-grade ore used in Alabama furnaces, the consumption of ore per ton of pig iron is higher than in any other State.

The iron ore used at Fontana, Calif., furnaces came from the Vulcan mine in San Bernardino County, Calif., and the Senter Walker mine in Iron County, Utah. Manganese ore from Lower California was also used.

Maryland furnaces used foreign iron ore from Africa, Chile, and Cuba, as well as manganiferous ore and iron ore from the Lake Superior district.

Blast furnaces in Illinois, Indiana, Kentucky, Michigan, Minnesota, and West Virginia used Lake Superior iron ore and manganiferous iron ore almost exclusively.

In New York the furnaces in the Buffalo district used ore from the Lake Superior district and Canada and magnetite from New York; the furnace at Troy consumed magnetite sinter from the Chateaugay mine at Lyon Mountain, N. Y.

Ohio blast furnaces consumed magnetite sinter from New York and hematite from the Lake Superior district, both domestic and Canadian.

Virtually all the ore consumed in western Pennsylvania furnaces came from the Lake Superior district. Those in the eastern part of the State used some Lake ore, some magnetite ores from Pennsylvania, New Jersey, and New York, and some ore from Africa.

The Colorado furnaces used hematite from the Sunrise mine in Wyoming, semialtered magnetite from the Duncan mine (Utah), and magnetite and manganese-bearing ores from New Mexico.

The Utah furnaces used semialtered magnetite from the Iron Mountain mine near Cedar City, Utah, and manganese-bearing ores, chiefly from Nevada and Utah. The sinter used was produced at Geneva and Provo from Iron Mountain fine ore.

The Houston, Tex., furnace used brown ore from eastern Texas and iron and manganese ore from Mexico.

Iron ore and other metallic materials consumed and pig iron produced, 1944–45, by States, in net tons

State	Metalliferous materials consumed					Pig iron produced	Materials consumed per ton of pig iron made			
	Iron and manganiferous iron ores		Sinter	Miscellaneous [1]	Total		Ores	Sinter	Miscellaneous	Total
	Domestic	Foreign								
1944										
Alabama	7,490,510	1,844	1,988,494	180,177	9,661,025	3,949,172	1.897	0.503	0.046	2.446
California, Colorado, Utah	2,079,786	11,369	995,416	80,446	3,167,017	1,717,680	1.217	.580	.047	1.844
Illinois	9,425,135	-------	718,680	815,810	10,959,625	5,685,533	1.658	.126	.144	1.928
Indiana	11,689,304	-------	1,063,556	856,404	13,609,264	6,850,642	1.707	.155	.125	1.987
Kentucky	1,169,976	-------	40,571	200,324	1,410,871	728,588	1.605	.056	.275	1.936
Maryland	3,081,872	8,174	993,741	708,488	4,792,275	2.515,049	1.229	.395	.281	1.905
Michigan	2,776,341	-------	220.801	129,709	3,126.851	1,621,979	1.712	.136	.080	1.928
Minnesota	975,872	-------	88,564	68,282	1,132,718	571,185	1.708	.155	.120	1.983
New York	6,222,288	53.076	776,636	406,100	7,458,100	3,832,192	1.637	.203	.106	1.946
Ohio	19,231,953	-------	4,124,907	2,034,877	25,391,737	13,373,397	1.438	.309	.152	1.899
Pennsylvania	27,094,019	12,874	4,244,391	3.617,864	34,969,148	18,507,068	1.465	.229	.196	1.890
Texas	247,560	61,517	----------	----------	309,077	150,015	2.060	------	------	2.060
West Virginia	2,301,250	8,211	99,555	129,407	2,538,423	1,355,333	1.704	.073	.096	1.873
Massachusetts, Tennessee, Virginia	186,154	-------	46,819	20,537	253.510	145,926	1.275	.321	.141	1.737
	93,972,020	157,065	15,402,131	9,248,425	118,779,641	61,003,759	1.543	.252	.152	1.947

[1] Excludes recycled materials.

Iron ore and other metallic materials consumed and pig iron produced, 1944–45, by States, in net tons—Continued

State	Metalliferous materials consumed					Pig iron produced	Materials consumed per ton of pig iron made			
	Iron and manganiferous iron ores		Sinter	Miscellaneous[1]	Total		Ores	Sinter	Miscellaneous	Total
	Domestic	Foreign								
1945										
Alabama	6,673,324	4,206	1,801,589	197,897	8,677,016	3,581,993	1.864	0.503	0.055	2.422
California	361,568	7,349	209,272	55,801	633,990	327,244	1.127	.639	.171	1.937
Colorado, Utah	1,657,112	-------	697,609	64,781	2,419,502	1,314,081	1.261	.531	.049	1.841
Illinois	8,736,849	-------	688,426	756,688	10,181,963	5,045,609	1.732	.136	.150	2.018
Indiana	10,348,308	-------	917,062	866,061	12,131,431	5,981,717	1.730	.153	.145	2.028
Kentucky	1,016,140	-------	42,609	169,239	1,227,988	631,105	1.610	.068	.268	1.946
Maryland	2,753,375	67,264	754,583	678,903	4,254,125	2,246,941	1.255	.336	.302	1.893
Michigan	2,504,060	-------	261,663	93,972	2,859,695	1,454,131	1.722	.180	.065	1.967
Minnesota	832,643	-------	1,383	86,801	920,827	466,758	1.784	.003	.186	1.973
New York	5,320,334	36,123	673,963	356,677	6,387,097	3,294,724	1.626	.205	.108	1.939
Ohio	15,366,511	57,792	3,869,945	1,942,654	21,236,902	11,258,960	1.370	.344	.172	1.886
Pennsylvania	22,938,574	20,614	4,010,518	3,358,140	30,327,846	16,172,296	1.420	.248	.207	1.875
Tennessee, Texas	235,324				347,816	176,506	1.688	.250	.033	1.971
Tennessee		-------	44,128	-------						
Texas		62,621	-------	5,743						
West Virginia	1,990,100	82,045	83,562	157,122	2,312,829	1,272,148	1.629	.066	.123	1.818
	80,734,222	338,014	14,056,312	8,790,479	103,919,027	53,224,213	1.523	.264	.165	1.952

[1] Excludes recycled materials.

Foreign iron and manganiferous iron ore consumed in the manufacture of pig iron in the United States, 1944–45, by sources of ore, in net tons

Source	1944	1945	Source	1944	1945
Africa	21,048	83,926	Mexico	72,886	74,176
Canada	61,287	57,792	Source not stated	-----------	116,164
Chile	-----------	3,284			
Cuba	1,844	2,672	Total	157,065	338,014

VALUE AT BLAST FURNACES

The average value of all grades of pig iron given in the following table is based upon reports of producers to the Bureau of Mines. The figures represent the values f. o. b. blast furnaces and do not include the values of ferro-alloys. The general average value for all grades of pig iron at the furnaces was $22.01 a net ton in 1945 compared with $20.97 in 1944.

Average value per net ton of pig iron at blast furnaces in the United States, 1940–45, by States

State	1940	1941	1942	1943	1944	1945
Alabama	$14.30	$17.25	$17.30	$17.35	$17.34	$18.39
Illinois	18.05	20.79	21.40	21.43	20.92	22.98
Indiana	18.26	21.22	22.17	22.39	22.41	23.11
Michigan	13.78	15.72	15.35	16.60	17.21	17.60
New York	16.89	17.91	19.63	20.20	19.96	22.83
Ohio	18.81	20.67	21.64	21.78	21.96	22.99
Pennsylvania	19.40	21.07	21.51	21.49	21.48	22.37
Western States	(1)	(1)	(1)	[2] 18.59	[2] 19.04	[2] 19.49
Other States [3]	15.20	18.62	19.09	[4] 19.48	[4] 20.10	[4] 20.48
Average for United States	17.90	20.13	20.77	20.95	20.97	22.01

[1] Colorado and Utah included with other States.
[2] California, Colorado, and Utah.
[3] Includes States entered as "(1)" and Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Tennessee, Texas, Virginia, and West Virginia.
[4] Excludes Iowa.

COMMERCIAL QUOTATIONS

The average monthly prices of Foundry, Basic, and Bessemer pig iron at Valley furnaces and of Foundry pig iron at Birmingham furnaces, according to published market quotations, are summarized in the following table:

Average monthly prices per net ton of chief grades of pig iron, 1944–45 [1]

Month	Foundry pig iron at Birmingham furnaces		Foundry pig iron at Valley furnaces		Bessemer pig iron at Valley furnaces		Basic pig iron at Valley furnaces	
	1944	1945	1944	1945	1944	1945	1944	1945
January	$18.20	$18.20	$21.43	$21.43	$21.88	$21.88	$20.98	$20.98
February	18.10	18.68	21.43	21.91	21.88	22.36	20.98	21.46
March	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
April	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
May	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
June	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
July	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
August	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
September	18.20	19.09	21.43	22.32	21.88	22.77	20.98	21.88
October	18.20	19.29	21.43	22.52	21.88	22.96	20.98	22.07
November	18.20	19.76	21.43	22.99	21.88	23.44	20.98	22.54
December	18.20	19.76	21.43	22.99	21.88	23.44	20.98	22.54
Average	18.20	19.11	21.43	22.34	21.88	22.79	20.98	21.89

[1] Metal Statistics, 1946.

FOREIGN TRADE

Pig iron imported for consumption in the United States, 1941–45, by countries, in net tons [1]

Country	1941	1943	1944	1945
North America: Canada	308	49	5,778	21,433
Europe: United Kingdom		560		
Asia: India and Dependencies		500		
Oceania: Australia	3,367	336		
	3,675	1,445	5,778	21,433
Value	$61,130	$41,408	$116,408	$440,283

[1] None imported in 1942.

Pig iron exported from the United States, 1944–45, by countries, in net tons

Country	1944	1945
North America:		
Canada	8,949	6,106
Cuba	544	1,923
Iceland	111	129
Jamaica	112	
Mexico	6	338
Other North America	174	104
South America:		
Argentina		5,660
Bolivia	147	140
Chile	2,332	2,608
Colombia	2,886	3,661
Ecuador	30	236
El Salvador		124
Paraguay	11	123
Peru	1,665	1,877
Uruguay	2,555	3,078
Venezuela	56	836
Other South America	17	70
Europe:		
Belgium and Luxemburg		7,790
France		14,000
Italy		10,643
Portugal	1,936	2,842
Sweden		22,062
U. S. S. R.	4,028	376
United Kingdom	131,888	1,524
Other Europe	528	710
Asia: Palestine and Trans-Jordan		1,470
Africa:		
Algeria	2,961	199
Belgian Congo		168
Egypt	25	1,391
French West Africa	1	287
Morocco, French	1,122	
Other Africa	394	493
	162,478	90,968
Value	$4,307,389	$2,396,175

CONSUMPTION

Consumption of pig iron in 1945 decreased 13 percent from 1944. Pig iron, a product of the blast furnace, is a semiraw material and, except for the small quantity used in direct castings, moves to steel- or iron-melting furnaces for further refining, alone or mixed with other ingredients. In 1945, 88 percent of the pig iron went to steel-making furnaces (open-hearth, bessemer, and electric) to be processed into steel. Direct castings took 4 percent and the remaining 8 percent was consumed in iron-making furnaces, of which the cupola is the most important. It is noteworthy that during 1945 pig-iron consumption in cupola furnaces increased 124,000 net tons over 1944 and 463,000 tons over 1943, whereas all other furnaces showed a decrease. This is an outcome of the progressive increase in supply of Foundry pig iron during the last few years. Pig iron was used to replace purchased scrap, as indicated by a 233,000 net ton decrease in purchased-scrap consumption in 1945 from 1944 and a drop of 808,000 tons from 1943.

Consumption of pig iron in the United States, 1942–45, by type of furnace

Type of furnace or equipment	1942		1943		1944		1945	
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total
Open-hearth	45,538,846	77.1	47,107,608	78.1	48,281,168	79.2	41,682,581	78.4
Bessemer	6,131,222	10.4	6,257,927	10.4	5,583,027	9.2	4,750,817	8.9
Electric	92,878	.2	393,819	.6	240,482	.4	163,457	.3
Cupola [1]	4,490,532	7.6	3,602,918	6.0	3,941,159	6.5	4,084,091	7.7
Air, Brackelsberg	555,436	.9	537,902	.9	499,457	.8	433,953	.8
Crucible	221	(2)	457	(2)	863	(2)	552	(2)
Puddling	49,835	.1	38,231	.1	28,166	(2)	22,725	(2)
Direct castings [1]	2,183,913	3.7	2,376,297	3.9	2,377,299	3.9	2,049,001	3.9
	59,042,883	100.0	60,315,159	100.0	60,951,621	100.0	53,187,177	100.0

[1] Some pig iron used in making direct castings included in cupola.
[2] Less than 0.05 percent.

Plants using pig iron in 1945 were located in all 48 States and the District of Columbia, but consumption is concentrated largely in the steel-making centers of the North Central, Middle Atlantic, and Southeastern States. These areas in 1945 used about 97 percent of the pig iron, Pennsylvania (the leading consumer) taking about 31 percent of the total and Ohio (the second-largest consumer) 20 percent.

Consumption of pig iron in the United States, 1942–45, by States and districts

State and district	1942		1943		1944		1945	
	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons	Consumers	Net tons
Connecticut	61	138,938	56	113,588	57	101,816	61	104,676
Maine	13	8,763	14	6,133	15	6,543	16	6,692
Massachusetts	101	244,993	103	225,465	104	192,870	103	184,432
New Hampshire	16	20,523	15	5,830	16	6,785	16	8,908
Rhode Island	12	58,116	12	46,756	12	39,858	12	38,670
Vermont	12	20,653	13	14,751	13	12,057	12	11,133
Total New England	215	491,986	213	412,523	217	359,929	220	354,511
Delaware	7	532,783	7	415,936	7	355,486	8	331,639
New Jersey	84		77		74		81	
New York	200	3,015,417	198	3,032,096	194	2,958,342	197	2,598,306
Pennsylvania	392	18,843,804	375	19,367,283	380	19,095,662	434	16,047,518
Total Middle Atlantic	683	22,392,004	657	22,815,315	655	22,409,490	720	18,977,463
Alabama	71	3,408,958	68	3,101,043	67	3,263,647	69	2,884,295
District of Columbia	1	3,055,553	1	3,156,432	1	3,185,611	3	2,848,408
Kentucky	23		23		24		24	
Maryland	28		21		22		26	
West Virginia	27	1,624,014	28	1,748,020	25	1,671,046	25	1,433,478
Florida	15	81,229	18	88,719	19	89,835	18	88,111
Georgia	44		45		49		52	
Mississippi	6	615	6	576	6	903	6	1,023
North Carolina	42	16,076	42	13,464	46	18,062	48	22,886
South Carolina	14	4,532	15	4,610	17	4,779	17	5,355
Tennessee	51	165,331	52	134,878	54	162,913	55	176,736
Virginia	47		51		49		53	
Total Southeastern	369	8,356,308	370	8,247,742	379	8,396,796	396	7,460,292
Arkansas	3	3,053	3	4,098	5	6,826	5	7,944
Oklahoma	7		10		13		12	
Louisiana	6		7		12		13	
Texas	28	4,428	40	23,715	45	152,058	42	174,497
Total Southwestern	44	7,481	60	27,813	75	158,884	72	182,441
Illinois	212	5,369,942	208	5,266,187	209	5,158,045	225	4,426,898
Indiana	127	6,963,040	126	7,218,967	131	7,453,187	142	6,543,439
Iowa	54	64,012	51	68,883	55	103,055	56	83,412
Minnesota	57	308,937	59	412,853	58	443,943	63	426,666
Missouri	53	81,677	53	123,124	59	130,537	56	106,734
Kansas	11	5,882	14	6,682	21	10,381	24	13,532
Nebraska	10		11		12		13	
Michigan	175	2,104,082	172	2,098,447	178	2,332,201	189	2,228,616
Wisconsin	114		112		110		122	
North Dakota	-----	-----	1	210	1	412	1	578
South Dakota	2	76	2		1		1	
Ohio	325	11,958,323	324	12,410,067	335	12,271,656	339	10,803,564
Total North Central	1,140	26,855,971	1,133	27,605,420	1,170	27,903,417	1,231	24,633,439
Arizona	2	36	2	81	3	91	4	133
Nevada								
New Mexico								
Colorado	18	666,254	16	721,672	20	1,082,544	28	1,067,032
Utah								
Idaho	5	648	4	468	3	367	4	495
Wyoming								
Montana								
Total Rocky Mountain	25	666,938	22	722,221	26	1,083,002	36	1,067,660
Oregon	17	17,178	21	35,699	33	39,614	31	34,834
Washington	30		38		37		40	
California	93	255,017	114	448,426	128	600,489	137	476,537
Total Pacific Coast	140	272,195	173	484,125	198	640,103	208	511,371
Total United States	2,616	59,042,883	2,628	60,315,159	2,720	60,951,621	2,883	53,187,177

WORLD PRODUCTION

The following table shows the production of pig iron, by countries, from 1939 to 1945, insofar as statistics are available.

World production of pig iron (including ferro-alloys), 1939–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943	1944	1945
Australia [2]	1,122,334	1,231,459	1,499,392	1,582,641	1,412,620	1,326,308	(3)
Belgian Congo	[4] 600	[4] 600	(3)	(3)	(3)	(3)	(3)
Belgium	3,058,730	1,789,830	1,422,090	1,269,450	1,630,570	718,490	718,400
Brazil	160,016	185,570	208,795	213,619	247,680	294,573	(3)
Canada	845,461	1,323,115	1,566,171	1,981,309	1,773,866	1,846,162	1,782,551
China	[5] 700,000	[5] 700,000	[5] 1,380,000	[5] 2,400,000	[6] 84,301	[6] 40,134	(3)
Czechoslovakia	[7] 1,000,000	(8)	(3)	(3)	(3)	(3)	440,000
Finland	34,163	26,193	22,170	28,886	42,449	(3)	(3)
France	7,455,000	[9] 4,600,000	[10] 1,504,000	[10] 1,586,000	[10] 2,128,000	[10] 1,103,000	1,185,000
Germany [11] / Austria	[7] 20,300,000	[9] 21,000,000	(3)	(3)	(3)	(3)	(3)
Hungary	[7] 460,000	(3)	(3)	(3)	(3)	(3)	(3)
India, British	1,785,242	2,026,241	2,042,123	1,859,108	1,776,941	(3)	(3)
Italy	1,095,785	1,121,786	1,109,857	[12] 889,259	[12] 643,806	[12] 230,995	[12] 65,838
Japan	[4] 3,000,000	[9] 3,000,000	(3)	(3)	(3)	----------	(3)
Korea (Chosen)	290,000	238,000	278,000	366,000	514,000	530,000	138,000
Luxemburg	[7] 1,800,000	[9] 1,000,000	(3)	(3)	(3)	(3)	324,000
Mexico	[12] 99,626	[12] 93,179	[12] 96,638	[12] 123,761	[12] 123,325	135,157	208,186
Netherlands	284,004	(3)	(3)	(3)	(3)	(3)	(3)
Norway	190,785	147,535	123,294	110,838	144,855	123,745	(3)
Poland	[7] 1,000,000	(8)	(3)	(3)	(3)	(3)	228,249
Rumania	119,000	[4] 122,227	(3)	[4] 160,000	175,000	(3)	(3)
Spain	473,360	588,076	545,148	549,030	697,318	564,294	482,158
Sweden	691,402	787,211	749,470	770,773	780,000	846,500	[4] 755,700
Switzerland [4]	30,000	2,000	10,000	10,000	10,000	10,000	2,770
Turkey	(3)	81,248	86,057	67,350	55,259	69,795	(3)
Union of South Africa	300,227	303,923	360,000	362,800	486,800	471,520	555,700
U. S. S. R.	[7] 15,200,000	[9] 15,200,000	[4] 13,100,000	[4] 7,075,000	(3)	(3)	(3)
United Kingdom	8,108,100	8,336,700	7,510,600	7,726,000	7,302,250	6,844,621	7,221,474
United States	32,321,653	43,026,030	51,456,627	55,316,075	56,969,248	57,059,457	49,855,561
Yugoslavia	61,106	84,000	[13] 50,561	(3)	(3)	(3)	(3)
	102,029,000	107,695,000	(3)	(3)	(3)	(3)	(3)

[1] Pig iron is produced in Chile, New Zealand, and Philippine Islands, in addition to the countries listed, but production figures are not available.
[2] Year ended June 30.
[3] Estimate included in total for 1940; data not available for other years.
[4] Estimate.
[5] Estimated production includes Manchuria.
[6] Unoccupied China.
[7] Approximate production as published by Steel, vol. 196, No. 1, January 1940, p. 269.
[8] Included in German figure in 1940.
[9] Approximate production as published by Iron Age, vol. 147, No. 1, Jan. 2, 1941, p. 61.
[10] Excluding Lower Rhine and Moselle; data not available on those areas.
[11] Beginning with March 1935, production of the Saar included with that of Germany.
[12] Excluding ferro-alloy production, for which data are not yet available.
[13] Croatia only.

FERRO-ALLOYS

PRODUCTION AND SHIPMENTS

The production of ferro-alloys in 1945 totaled 1,732,423 net tons compared with 1,893,855 tons in 1944—a decrease of 9 percent. In 1945 ferro-alloys were made at 15 blast-furnace plants, 25 electric-furnace plants, and 3 aluminothermic plants. The 25 electric-furnace plants include 5 plants that made ferrophosphorus and 2 plants that made ferrosilicon as a byproduct. Shipments of all classes of ferro-alloys in 1945 decreased 11 percent in quantity and 14 percent in value from 1944. Pennsylvania again was by far the largest producer and shipper of ferro-alloys in 1945, both in tonnage and value. Of the ferro-alloys shipped in 1945, Pennsylvania contributed 35.8 percent of the total tonnage and 42.1 percent of the total value; New York was second, with 17.3 percent of the tonnage and 22.9 percent of the value.

A description of German ferro-alloy operations was given by Kinzel [2] during 1945.

Ferro-alloys produced and shipped from furnaces in the United States, 1944–45

Alloy	1944			1945		
	Production (net tons)	Shipments		Production (net tons)	Shipments	
		Net tons	Value		Net tons	Value
Ferromanganese	702,632	715,059	$91,406,229	619,760	610,376	$78,907,189
Spiegeleisen	165,530	155,325	4,851,490	139,039	157,774	5,108,144
Ferrosilicon	700,358	686,895	39,531,552	660,403	615,596	34,968,350
Ferrophosphorus	31,428	7,504	473,084	27,958	10,358	623,791
Ferrotungsten	6,696	6,911	19,764,068	4,107	3,987	11,865,019
Ferotitanium Ferrovanadium	14,986	14,669		11,480	10,353	
Ferromolybdenum Molybdic oxide Calcium molybdate and compounds	23,339	25,279	89,987,616	23,150	19,615	79,037,164
Other varieties [1]	248,886	249,314		246,526	233,598	
	1,893,855	1,860,956	246,014,039	1,732,423	1,661,657	210,509,657

[1] Silicomanganese, manganese briquets, ferrochromium, ferrocolumbium, ferroboron, zirconium-ferrosilicon, alsifer, grainals, and simanal.

Ferromanganese.—The ferromanganese produced in 1945 averaged 79 percent manganese and came from eight blast-furnace plants and two electric-furnace plants. Of the manganese ore used in 1945 in the manufacture of ferromanganese, 90.2 percent was from foreign sources. During 1945 steel producers used 13.5 pounds of metallic manganese as ferro-alloys per ton of steel produced. Of this quantity, 12 pounds were in the form of ferromanganese. In addition to the 13.5 pounds, 0.1 pound was added directly to the steel in the form of manganese ore. A total of 641,622 tons of ferromanganese was consumed during the year—virtually all by the iron and steel industry. A detailed discussion of manganese alloys appears in the chapter on Manganese.

Spiegeleisen.—Production of spiegeleisen in 1945 dropped 16 percent from 1944, but shipments from furnaces were 2 percent greater. The output came from five blast-furnace plants and averaged 19.74 percent manganese. Shipments in 1945 totaling 157,774 tons were valued at $5,108,144 f. o. b. furnaces or $32.38 per ton compared with $31.23 in 1944 and $32.16 in 1943. Six-tenths of a pound of manganese metal in the form of spiegeleisen was used per ton of steel produced in 1945.

Ferrosilicon.—With respect to tonnage produced and shipped, ferrosilicon in 1945 supplanted ferromanganese as the most important ferro-alloy. Of the 660,403 tons of ferrosilicon produced, 36 percent or 237,274 tons were made in blast furnaces and 64 percent or 423,129 tons in electric furnaces. Included in the latter figure are 415 tons of ferrosilicon produced as a byproduct in the manufacture of artificial

[2] Kinzel, A. B., Ferro-Alloy Manufacture and Use: U. S. Office of Military Government for Germany November 8, 1945, 15 pp.

abrasives. The silicon content of the blast-furnace output averaged 9.6 percent and that of the electric furnace 41 percent. Ferrosilicon containing 5 to 20 percent silicon is classified as silvery pig iron. Shipments of all grades of ferrosilicon in 1945 declined 10 percent from 1944 and totaled 615,596 tons valued at $34,968,350. Exports in 1945 totaled 1,089 net tons valued at $114,520. Imports were 23,067 tons and averaged 31 percent silicon.

In 1945 steel plants used about half of the total consumption of silvery pig iron (iron foundries used most of the remainder) and over 90 percent of the other grades of ferrosilicon. In the manufacture of steel, alloys of low silicon content are used as deoxidizers and scavengers, whereas, in the manufacture of iron castings, this type is used for the alloying effect of the silicon. The most important grade of ferrosilicon is the standard 50 percent, which is used as a deoxidizer and solidifier in the manufacture of most grades of killed and semi-killed steel. Only a small quantity of this alloy is used in foundries and other industries. Alloys containing 75 percent silicon and over are used as ladle additions in gray-iron foundries and in the manufacture of high-silicon steels for use in electrical equipment and high-silicon spring steel. Another important use of ferrosilicon is in the beneficiation of low-quality ores. In the beneficiation process, finely ground 15-percent ferrosilicon is added to water and agitated—the resulting high-density fluid floats a part of the feed, which may be either the valuable portion or the waste.

Consumption of ferrosilicon, silicon metal, and miscellaneous silicon alloys in the United States in 1945, by industries, in net tons [1]

Alloy	Steel ingots and castings [2]	Steel castings [3]	Miscellaneous	Total
Silvery pig iron: 5-20 percent silicon	149, 974	17, 282	165, 639	332, 895
Ferrosilicon:				
50 percent silicon	140, 292	20, 507	12, 945	173, 744
75 percent silicon	39, 444	290	4, 049	43, 783
Other grades [4]	26, 699	555	26, 301	53, 555
	356, 409	38, 634	208, 934	603, 977

[1] As reported by companies that account for about 96 percent of the total consumption.
[2] Includes only that part of castings made by companies that also produce steel ingots.
[3] Excludes companies that produce both steel castings and steel ingots.
[4] Includes grades of ferrosilicon not listed separately and other miscellaneous silicon alloys.

Ferrophosphorus.—All ferrophosphorus in 1945 was produced in electric furnaces as a byproduct in the manufacture of phosphate fertilizers and other chemicals. Shipments from producing plants totaled 10,358 net tons valued at $623,791 compared with 7,504 tons valued at $473,084 in 1944. Exports in 1945 totaled 603 net tons valued at $42,204.

Ferrotungsten.—Output of ferrotungsten in 1945 dropped to 4,107 net tons from 6,696 tons in 1944 and 7,561 tons in 1943. Shipments in 1945 contained 79.65 percent (6,351,054 pounds) tungsten and were valued at $1.868 per pound of contained metal. The ferrotungsten was produced in electric furnaces from both domestic and foreign ores. Four hundred thirty-one net tons were exported in 1945.

Ferrochromium.—Ferrochromium, an electric furnace product, was produced by four companies in six States during 1945. Industrial consumers reported using 144,447 net tons of ferrochromium in 1945 compared with 159,911 tons in 1944. Exports in 1945 totaled 1,471 tons.

Ferromolybdenum.—The bulk of the ferromolybdenum produced in 1945 was made by the aluminothermic process; some was made in electric furnaces. All was produced in Pennsylvania and averaged 62.8 percent molybdenum. Eight hundred eighty-four net tons valued at $1,050,863 were exported.

Molybdic oxide, calcium molybdate, and molybdenum compounds.—As these compounds are used as alloying agents in the production of iron and steel, they are included with ferro-alloys. These materials are considerably less expensive than ferromolybdenum and consequently are used to a greater extent; the Mo content averaged 54.3 percent in 1945.

Ferrotitanium.—Virtually all of the ferrotitanium produced in 1945 was made in electric furnaces—a little was produced by the aluminothermic process. The ferrotitanium produced in 1945 averaged 20 percent titanium, and both foreign and domestic ores were consumed in its manufacture. Ferrotitanium is used as a deoxidizer and scavenger in steel manufacture. When used as a deoxidizer, ferrotitanium is charged in combination with silicon or some other deoxidizing agent, the titanium alloy being added as a final purifier. As an alloying agent, ferrotitanium prevents intergranular corrosion. Combined exports of ferrotitanium and ferrocarbontitanium in 1945 totaled 744 net tons valued at $122,887.

Ferrovanadium.—In 1945 ferrovanadium was produced by electric and aluminothermic processes using foreign and domestic ores. The alloy averaged 43 percent vanadium compared with 44 percent in 1944. A total of 86 net tons was exported in 1945.

Silicomanganese.—The silicomanganese produced in 1945 averaged 68 percent manganese and was produced in electric furnaces.

Manganese briquets.—The foundry industry is the principal user of manganese briquets, the alloy being added to molten iron to overcome the harmful effects of sulfur and to act as a deoxidizer and scavenger. The briquets produced in 1945 averaged 58 percent manganese.

Ferroboron.—Shipments of ferroboron in 1945 averaged 14.6 percent boron. Ferroboron is used in special steels as a hardening agent, but it is also a highly efficient deoxidizer.

Ferrocolumbium.—Ferrocolumbium is used in stainless steels to prevent intergranular corrosion. It also reduces air hardening and oxidation at high temperatures in chromium steels. In 1945 the output of ferrocolumbium averaged 56 percent Cb and was produced in electric furnaces.

Zirconium-ferrosilicon.—The zirconium-ferrosilicon produced in 1945 averaged 14 percent Zr. Zirconium is a powerful deoxidizer and scavenger, reduces age hardening, and thereby improves deep drawing properties of sheet steel. It is used as a substitute for ordinary ferrosilicon and is more effective.

Producers of ferro-alloys in the United States in 1945

Producer	Plant	Alloy
American Agricultural Chemical Co.	South Amboy, N. J.	Ferrophosphorus (byproduct).
Bethlehem Steel Co.	Johnstown, Pa.	Ferromanganese.
Climax Molybdenum Co.	Langeloth, Pa.	Ferromolybdenum, calcium molybdate, molybdenum oxide, oxide briquets, molybdenum trioxide, molybdenum silicide.
Electro Metallurgical Co.	Alloy, W. Va. Ashtabula, Ohio Columbiana, Ohio Holcomb Rock, Va. Niagara Falls, N. Y. Portland, Oreg. Sheffield, Ala. Spokane, Wash.	Ferromanganese, silicomanganese, manganese briquets, ferrosilicon, silicon briquets, zirconium-ferrosilicon, ferrochromium, chromium briquets, ferrotungsten, ferrovanadium, ferromolydenum, ferrotitanium, ferroboron, and ferrocolumbium.
General Abrasive Co., Inc.	Niagara Falls, N. Y.	Ferrosilicon (byproduct).
Globe Iron Co.	Jackson, Ohio	Silvery pig iron.
Hanna Furnace Corp.	Buffalo, N. Y.	Do.
Inland Steel Co.	E. Chicago, Ind.	Spiegeleisen.
Jackson Iron & Steel Co.	Jackson, Ohio	Silvery pig iron.
Keokuk Electro-Metals Co.	Keokuk, Iowa	Ferrosilicon and silvery pig iron.
E. J. Lavino & Co.	Reusens, Va. Sheridan, Pa.	Ferromanganese.
Metal & Thermit Corp.	Jersey City, N. J.	Ferrotitanium.
Molybdenum Corporation of America.	Washington, Pa.	Ferrotungsten, ferromolybdenum, calcium molybdate, molybdenum oxide, ferroboron.
Monsanto Chemical Co.	Anniston, Ala. Columbia, Tenn.	Ferrosilicon (byproduct), ferrophosphorus (byproduct).
New Jersey Zinc Co.	Palmerton, Pa.	Spiegeleisen.
Ohio Ferro-Alloys Co.	Philo, Ohio Tacoma, Wash.	Ferrosilicon simanal, ferrochromium.
Permanente Metals Corp.	Permanente, Calif.	Ferrosilicon and silicon briquets.
Phosphate Mining Co.	Nichols, Fla.	Ferrophosphorus (byproduct).
Pittsburgh Metallurgical Co.	Charleston, S. C. Niagara Falls, N. Y.	Ferrosilicon, silvery pig iron, and ferrochromium.
Sloss-Sheffield Steel & Iron Co.	N. Birmingham, Ala.	Ferromanganese.
Southern Ferro Alloys Co.	Chattanooga, Tenn.	Ferrosilicon.
Tennessee Products Corp.	Rockwood, Tenn.	Ferromanganese.
Tennessee Valley Authority	Muscle Shoals, Tenn.	Ferrophosphorus (byproduct).
Titanium Alloy Mfg. Co.	Niagara Falls, N. Y.	Ferrotitanium.
United States Steel Corp. Subsidiaries.	Ensley, Ala. Gary, Ind. Clairton, Pa. Duquesne, Pa. Etna, Pa.	Ferromanganese and spiegeleisen.
Vanadium Corporation of America.	Niagara Falls, N. Y. Bridgeville, Pa.	Ferrosilicon, silicon briquets, alsifer, ferrochromium, ferrovanadium, ferrotitanium, and grainals.
Victor Chemical Works	Mt. Pleasant, Tenn.	Ferrophosphorus (byproduct).

FOREIGN TRADE

Imports and exports of the rarer ferro-alloys are not recorded separately but are grouped as shown in the following tables. Ferrosilicon comprised most of the imports in 1944; ferromanganese supplied the bulk in 1945.

Ferro-alloys and ferro-alloy metals imported for consumption in the United States, 1944–45, by varieties

Variety of alloy	1944			1945		
	Gross weight (net tons)	Content (net tons)	Value	Gross weight (net tons)	Content (net tons)	Value
Ferromanganese:						
Containing over 1 percent carbon	4,199	3,308	$394,641	----	----	----
Containing not less than 4 percent carbon	----	----	----	35,521	27,694	$3,733,846
Manganese silicon	----	----	----	(1)	5	7,891
Spiegeleisen	3,761	(1)	153,032	3,146	(1)	142,883
Ferrochrome or ferrochromium: Containing 3 percent or more carbon	113	79	24,795	6,371	4,292	989,177
Ferrosilicon	22,646	4,189	750,153	23,067	7,191	936,006
Calcium silicide (calcium silicon content)	----	----	----	(1)	(2)	22
Tungsten metal	----	----	----	(1)	2	7,111
Tungsten acid and other compounds of tungsten, n. s. p. f. (tungsten content)	(1)	(3)	250	----	----	----

[1] Not recorded. [2] 164 pounds. [3] 21 pounds

Ferromanganese and ferrosilicon imported for consumption in the United States, 1944–45, by countries

Country	Ferromanganese (manganese content)				Ferrosilicon (silicon content)			
	1944		1945		1944		1945	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Canada	2, 232	$296, 359	27, 694	$3,733,846	4, 189	$750, 153	7, 191	$936, 006
India and Dependencies	1, 076	98, 282						
	3, 308	394, 641	27, 694	3, 733, 846	4, 189	750, 153	7, 191	936, 006

Ferro-alloys and ferro-alloy metals exported from the United States, 1944–45, by varieties

Variety of alloy	1944		1945	
	Net tons	Value	Net tons	Value
Ferromanganese	600	$101, 445	836	$175, 556
Spiegeleisen	202	6, 508	2, 393	82, 699
Other ferro-alloys [1]	7, 978	9, 307, 248	5, 381	3, 442, 388

[1] Includes ferrosilicon, ferrotungsten, ferrovanadium, and other ferro-alloys.

STEEL

GENERAL FEATURES

Steel production decreased 11 percent from 1944, although capacity for making steel increased 1,941,000 net tons to reach a new record total of 95,505,000 tons. Total production of steel in the United States in 1945 was 79,701,648 tons. Of the total 90.3 percent was made in open-hearth furnaces, 5.4 percent in bessemer converters, 4.3 percent in electric furnaces, and only 24 tons in crucible furnaces. In 1945, 91 percent of the domestic steel output was made in furnaces in the Northeastern district, 4.6 percent in the Southern district, and 4.4 percent in the Western district compared with 90.6, 4.5, and 4.9 percent, respectively, in 1944.

The data concerning steel production used by the Bureau of Mines are furnished by the American Iron and Steel Institute. The output from steel foundries that do not produce steel ingots is not included in the statistics.

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Steel capacity, production, and percent of operations, 1941–45, in net tons [1]

[Ingots and steel for castings [2]]

Year	Capacity	Production					
		Open hearth	Bessemer	Crucible	Electric and all other	Total	Percent capacity
1941	[3] 85, 158, 150	74, 389, 619	5, 578, 071	2, 313	2, 869, 256	82, 839, 259	97. 3
1942	[4] 90, 293, 000	76, 501, 957	5, 553, 424	2, 010	3, 974, 540	86, 031, 931	96. 8
1943	[5] 90, 636, 000	78, 621, 804	5, 625, 492	146	4, 589, 070	88, 836, 512	98. 0
1944	[5] 93, 564, 560	80, 363, 953	5, 039, 923	25	4, 237, 699	89, 641, 600	95. 8
1945	[5] 95, 505, 280	71, 939, 602	4, 305, 318	24	3, 456, 704	79, 701, 648	83. 5

[1] American Iron and Steel Institute.
[2] The figures include only that portion of the capacity and production of steel for castings used by foundries which were operated by companies producing steel ingots.
[3] Average annual capacity as of Jan. 1 and July 1, 1941.
[4] Annual capacity as of Jan 1, 1943.
[5] Annual capacity as of Dec. 31.

Open-hearth steel ingots and castings manufactured in the United States, 1941–45, by States, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

State	1941	1942	1943	1944	1945
New England States	462, 754	472, 521	487, 773	444, 101	432, 601
New York and New Jersey	4, 232, 521	4, 378, 808	4, 488, 951	4, 365, 108	3, 813, 333
Pennsylvania	23, 007, 147	23, 562, 866	24, 548, 335	24, 677, 513	21, 194, 721
Ohio	14, 746, 523	14, 769, 085	14, 834, 574	15, 011, 818	13, 402, 084
Indiana	10, 366, 380	10, 578, 989	10, 679, 645	10, 925, 049	10, 237, 621
Illinois	5, 998, 679	6, 335, 946	6, 350, 309	6, 496, 338	5, 812, 286
Other States	15, 575, 615	16, 403, 742	17, 232, 217	18, 444, 026	17, 046, 956
	74, 389, 619	76, 501, 957	78, 621, 804	80, 363, 953	71, 939, 602

Bessemer-steel ingots and castings manufactured in the United States, 1941–45, by States, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

State	1941	1942	1943	1944	1945
Ohio	2, 265, 987	2, 250, 717	2, 365, 326	2, 207, 176	1, 930, 956
Pennsylvania	1, 966, 779	1, 997, 547	1, 926, 316	1, 645, 247	1, 388, 284
Other States	1, 345, 305	1, 305, 160	1, 333, 850	1, 187, 500	986, 078
	5, 578, 071	5, 553, 424	5, 625, 492	5, 039, 923	4, 305, 318

Steel electrically manufactured in the United States, 1941–45, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

Year	Ingots	Castings	Total	Year	Ingots	Castings	Total
1941	2, 758, 611	110, 645	2, 869, 256	1944	4, 131, 703	105, 996	4, 237, 699
1942	3, 843, 757	130, 783	3, 974, 540	1945	3, 381, 678	75, 026	3, 456, 704
1943	4, 473, 377	115, 693	4, 589, 070				

The steel output for 1945 includes 8,647,711 net tons of alloy-steel ingots and castings, which represents 11 percent of the total. This figure includes steels in which the minimum of the range specified in one or more of the elements named exceeds the following percentages: Copper, 0.60 percent; manganese, 1.65 percent; and silicon, 0.60 percent. Steel containing aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, and zirconium in any percentage are included. The output of alloy steels in 1945 decreased 19 percent, whereas total steel decreased 11 percent from 1944. Of the total alloy-steel output in 1945, 65 percent came from basic open hearths, 3 percent from acid open hearths, 32 percent from electric furnaces, 18 tons from crucible furnaces, and none from Bessemer converters.

From the accompanying tables it will be seen that most of the steel made in electric furnaces (81 percent in 1945) is alloy steel. Typically, steels with higher alloy content are made in electric furnaces and steel with lower alloy content by the open-hearth process.

Alloy-steel ingots and castings manufactured in the United States, 1941–45, by processes, in net tons

[Includes only that portion of steel for castings produced in foundries operated by companies manufacturing steel ingots]

Process	1941	1942	1943	1944	1945
Open hearth:					
Basic	5, 306, 415	7, 524, 209	8, 539, 523	6, 494, 627	5, 572, 353
Acid	433, 240	608, 867	677, 416	515, 662	274, 889
Bessemer	3, 890				
Crucible	933	522	136	23	18
Electric	2, 461, 651	3, 392, 776	3, 932, 743	3, 622, 774	2, 800, 451
	8, 206, 129	11, 526, 374	13, 149, 818	10, 633, 086	8, 647, 711

CONSUMPTION OF METALLIFEROUS MATERIALS

During 1945 steel furnaces used 5,109,956 net tons of iron ore (excluding mill scale) and sinter. Of this quantity 24,465 tons were foreign, originating in Africa, Canada, Chile, and Sweden.

Both charge ore and feed ore are used in the basic open-hearth process. Charge ore is added to furnish oxygen to the charge before it is melted. This ore should be low in combined and uncombined moisture, silica content, and fines. Ore containing high quantities of silica requires large additions of limestone and consequently produces large volumes of slag, which reduce furnace efficiency.

Feed ore, which is added to the heat during the working period, should be hard, dense, coarse, and low in moisture. Although moderately high silica ore can be used as feed ore it is undesirable, as in charge ore, because of the larger quantity of slag necessitated. Lump ore, which is preferred as feed ore, commands a high price, and the supply is limited.

Sintered pyrites ash and sintered iron ore frequently are used as charge and feed ores. However, these materials are less dense than lump ore and lower in oxygen content. Consequently, more sinter is required to accomplish the same oxidation.

Metalliferous materials consumed in steel furnaces in the United States in 1945, by districts, in net tons

District	Iron ore		Sinter	Manganese ore		Ferro-alloys	Iron and steel scrap		Pig iron
	Domestic	Foreign		Domestic	Foreign		Home	Purchased	
Northeastern	3,638,006	24,465	1,212,441	(1)	(1)	(1)	23,031,556	15,867,057	42,658,910
Southeastern	15,321		77,931	(1)	(1)	(1)	923,171	388,844	2,395,522
Western	140,235		1,557	(1)	(1)	(1)	1,282,183	1,663,701	1,542,423
	3,793,562	24,465	1,291,929	1,915	7,245	1,388,000	25,236,910	17,919,602	46,596,855

1 Separation by districts not available.

FOREIGN TRADE

Imports and exports of iron and steel products are given in detail in the following tables.

Iron and steel imported for consumption in the United States, 1944–45, by commodities

Commodity	1944 Net tons	1944 Value	1945 Net tons	1945 Value
Semimanufactures:				
Steel bars:				
Solid or hollow, n. e. s	330	$51,676	1,592	$180,028
Hollow and hollow drill steel	(1)	3	37	7,436
Bar iron	1	100	24	3,461
Wire rods, nail rods, and flat rods up to 6 inches in width	2	883	2,197	256,983
Boiler and other plate iron and steel, n. e. s	5,652	292,611	72	47,443
Steel ingots, blooms, and slabs	14	2,886	1,655	115,774
Billets, solid or hollow	66	7,792	6,456	477,032
Die blocks or blanks; shafting, etc	229	64,595	212	71,703
Circular saw plates	2	1,444		
Sheets of iron or steel, common or black and boiler or other plate iron or steel	3	314	91	8,330
Sheets and plates and steel, n. s. p. f	7	1,237	2,487	225,472
Tin plate, terneplate, and taggers' tin	125	29,991	162	41,180
Manufactures:				
Structural iron and steel	28,016	1,666,062	2,682	162,755
Rails for railways	7,838	164,699	27,766	573,773
Rail braces, bars, fish plates or splice bars, and tie plates	2,055	79,879	4,708	163,805
Pipes and tubes:				
Cast-iron pipe and fittings	100	2,788	8	2,229
Other pipes and tubes	583	83,955	908	136,973
Wire:				
Barbed	600	30,000	(1)	19
Round wire, n. e. s	1	149	21	4,588
Telegraph, telephone, etc., except copper, covered with cotton jute, etc	154	77,271	63	49,299
Flat and steel strips not thicker than ¼-inch and not over 16 inches wide	20	47,922	1,956	1,306,179
Rope and strand	2,952	1,269,236	2,415	949,064
Galvanized fencing wire and wire fencing	7	670		
Hoop, band and strips, or scroll iron or steel, n. s. p. f	(1)	11	98	112,422
Nails	7	2,933	27	14,774
Castings and forgings, n. e. s	7,277	1,419,093	20,066	2,820,309

1 Less than 1 ton.

Iron and steel exported from the United States, 1944–45, by commodities

Commodity	1944		1945	
	Net tons	Value	Net tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	1,106,720	$50,306,657	203,746	$10,664,091
Iron and steel bars and rods:				
Iron bars	3,588	526,144	2,166	300,395
Concrete reinforcement bars	258,120	15,598,710	267,080	15,017,384
Other steel bars	390,008	56,661,804	332,456	35,240,227
Wire rods	123,804	6,077,566	109,334	5,493,116
Iron and steel plates, sheets, skelp, and strips:				
Boiler plates	24,058	1,542,639	25,543	1,517,602
Other plates, not fabricated	306,478	17,559,759	188,478	11,886,100
Skelp iron or steel	157,746	6,812,945	146,535	6,380,416
Iron and steel sheets, galvanized	95,122	7,304,714	174,746	15,158,621
Steel sheets, black, ungalvanized	780,930	58,113,719	742,423	53,291,346
Iron sheets, black	18,876	1,381,825	12,835	943,910
Strip band, and scroll iron or steel:				
Cold-rolled	85,791	12,976,801	57,756	7,853,605
Hot-rolled	126,164	14,035,549	84,668	6,505,636
Tin plate, terneplate, and taggers' tin	489,028	52,305,738	527,688	55,512,995
Manufactures-steel-mill products:				
Structural iron and steel:				
Water, oil, gas, and other storage tanks, complete and knocked-down material	43,765	5,233,074	33,371	4,394,255
Structural shapes:				
Not fabricated	166,050	8,669,946	286,412	14,428,679
Fabricated	54,742	7,655,386	57,378	8,711,478
Plates, fabricated, punched, or shaped	21,092	1,826,968	197,929	21,760,743
Metal lath	636	103,610	1,891	330,868
Frames, sashes, and sheet piling	14,164	855,119	22,620	1,431,83
Railway-track material:				
Rails for railways	316,915	12,989,007	327,994	14,439,299
Rail joints, splice bars, fishplates, and tie plates	76,641	4,858,575	69,245	4,313,944
Switches, frogs, and crossings	36,381	4,879,947	37,999	4,933,999
Railroad spikes	17,020	1,225,136	15,907	1,327,191
Railroad bolts, nuts, washers, and nut locks	4,560	754,960	6,419	1,078,990
Tubular products:				
Boiler tubes	77,990	14,616,258	52,724	8,140,464
Casing and oil-line pipe	198,618	20,071,346	256,770	24,522,719
Seamless black pipe, other than casing and oil line	45,068	6,336,503	21,576	2,355,272
Welded black pipe	63,591	6,108,319	65,325	6,206,191
Welded galvanized pipe	68,037	6,799,632	57,292	6,187,737
Malleable-iron screwed pipe fittings	4,548	1,781,795	3,681	1,534,075
Cast-iron screwed pipe fittings	769	220,166	938	278,819
Cast-iron pressure pipe and fittings	34,104	2,184,167	65,649	4,386,355
Cast-iron soil pipe and fittings	8,090	848,268	7,346	663,091
Riveted-steel or iron pipe and fittings	113,158	26,373,545	183,412	30,623,265
Wire and manufactures:				
Barbed	28,306	2,585,361	29,290	3,344,330
Galvanized wire	69,799	8,624,175	61,929	6,840,616
Iron and steel wire, uncoated	71,341	9,190,420	59,620	6,482,572
Wire rope and strand	39,098	16,269,662	31,607	12,300,784
Woven-wire fencing and screen cloth	8,943	3,449,514	9,646	3,027,289
All other	45,751	11,623,693	36,336	8,308,768
Nails and bolts (except railroad):				
Wire nails	42,675	3,497,808	31,264	2,870,862
Horseshoe nails	1,566	458,214	1,529	472,875
All other nails, including tacks and staples	9,550	1,584,636	9,549	1,822,689
Bolts, nuts, rivets, and washers (except aircraft and railroad)	56,112	14,008,450	41,805	10,638,205
Castings and forgings:				
Horseshoes and calks	298	46,014	1,681	260,174
Iron and steel, including car wheels, tires, and axles	174,867	37,610,799	140,995	20,052,876
Advanced manufactures:				
House-heating boilers and radiators	-	313,887	-	351,992
Oil burners and parts	-	730,678	-	2,299,341
Tools:				
Axes	-	645,183	-	684,018
Shovels, spades, scoops, and drainage tools	-	1,303,164	-	1,028,657
Hammers and hatchets	-	845,448	-	1,124,035
Saws, wood and metal cutting	-	6,678,542	-	5,775,987
All other tools	-	40,905,822	-	36,854,493

MANGANESE

By Norwood B. Melcher and John Hozik [1]

SUMMARY OUTLINE

GENERAL SUMMARY

The year 1945 witnessed a sharp decline in the wartime production rate of domestic manganese ore, but requirements continued to be met by a high rate of imports of foreign ore. Shipments from the U. S. S. R., which were temporarily terminated during the war, reentered the trade in April, and receipts from Chile and Union of South Africa were greatly expanded during the last half of 1945. Total imports during the year were 1,461,945 shorts tons—an increase of 26 percent over 1944 and only slightly under the record year 1941, when 1,562,133 tons were received.

Domestic production, which depended largely upon Government purchases during the war, was curtailed during 1945 as a result of new specifications which excluded ore containing less than (dry) 42 percent Mn. Output, as measured by shipments from mines, totaled 182,337 short tons compared with 247,616 tons in 1944. The value of manganese ore shipped in 1945 totaled $7,320,309 ($40.15 per short ton) compared with $9,014,875 ($36.41 per ton) in 1944. However, a larger proportion of high-grade ore was shipped in 1945, and the average price per long-ton unit increased only slightly—from 77 cents in 1944 to 79 cents in 1945. Eleven States contributed in 1945 compared with 13 during the previous year. The total number of shippers dropped from 133 in 1944 to 37 in 1945. At the end of 1945 there were no provisions for Government purchases of domestic manganese ore. Shipments of ferruginous manganese ore (10 to 35 percent manganese) amounted to 114,327 tons, and shipments of manganiferous iron ore (5 to 10 percent manganese) were 1,408,527 tons compared with 297,136 and 1,190,476 tons, respectively, in 1944.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Department of Commerce.

Salient statistics of the manganese industry in the United States, 1925–29 (average) and 1941–45, in short tons

	1925–29 (average)	1941	1942	1943	1944	1945
Manganese ore:						
Total shipments containing 35 percent or more Mn	66,429	87,794	190,748	205,173	247,616	182,337
Shipments of metallurgical ore	[1] 46,919	73,852	177,966	195,096	241,170	174,295
Shipments of battery ore	19,510	11,399	12,377	9,973	6,224	8,042
Imports for consumption	672,000	1,714,581	1,583,024	1,511,630	1,315,677	1,311,346
Ferro-alloys:						
Production of ferromanganese	343,123	580,704	661,338	702,484	702,632	619,760
Imports of ferromanganese [2] [3]	[4] 56,661	5,696	11,635	990	3,308	27,694
Production of spiegeleisen	106,919	177,915	186,026	149,036	165,530	139,039
Imports of spiegeleisen [2]	8,174	4,741	1,990	3,254	3,761	3,146
Exports of spiegeleisen and ferromanganese	4,221	5,155	7,223	12,824	802	3,209

[1] Includes small quantity of miscellaneous ore.
[2] Imports for consumption.
[3] Manganese content.
[4] Includes small quantity of other manganese alloys.

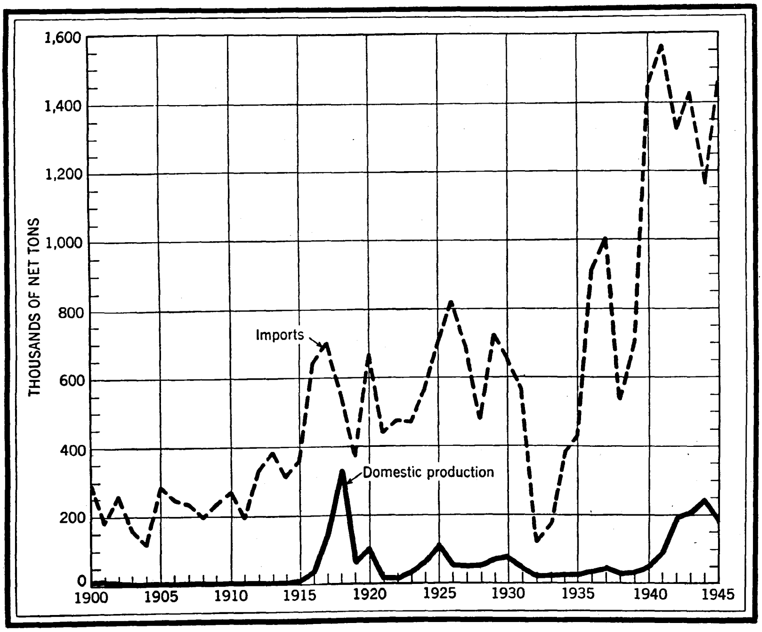

FIGURE 1.—Imports and domestic production (mine shipments) of manganese ore, 1900–1945. Statistics on imports shown in the graph represent general imports for 1900–1933, imports for consumption adjusted for changes in bonded warehouse stocks for 1934–39, and general imports for 1940–45.

Manganese ore stock-piled by the Office of Metals Reserve (successor to Metals Reserve Company, July 1, 1945) paced releases to industry during 1945. At the close of the year, ore stored by this agency in the United States totaled 1,076,113 long dry tons, compared with 991,341 tons at the end of 1944. Domestic ore comprised 25 percent (266,476 tons) compared with 26 percent (245,117 tons) on December 31, 1944. Total storage outside the United States (Brazil and Chile) on December 31, 1945, was 181,770 tons; on the same date of 1944, foreign storage (Chile and Cuba) amounted to 252,647 tons.

All Government purchases of domestic manganese ore ceased at the close of 1945; purchases of manganese nodules from the Anaconda Copper Mining Co., the largest domestic supplier, terminated on September 30, 1945.

In March the Bureau of Mines made public a record [2] of raw material exploration during World War II; a summary of results of manganese ore exploration in 15 States follows:

Tonnage and grade of manganese ore explored by the Bureau of Mines

Manganese, percent (approximate)	Tons	Manganese, percent (approximate)	Tons
8	1, 160, 000	40	8, 000
12	20, 188, 000	50	11, 000
15	485, 000		
18	3, 417, 000	Total	26, 528, 000
20	933, 000		
22	31, 000	3.5 (Boulder City, Nev.)	10, 000, 000
24–26	268, 000	Under 2 (Chamberlain, S. Dak.)	10, 000, 000
30	27, 000		

DOMESTIC PRODUCTION

The following table shows the various types of manganiferous materials shipped by domestic producers from 1941 to 1945.

Manganiferous raw materials shipped by producers in the United States, 1941–45, in short tons

Year	Metallurgical ore				Battery ore	Miscellaneous
	Manganese ore (35 percent or more Mn)	Ferruginous manganese ore (10 to 35 percent Mn)	Manganiferous iron ore (5 to 10 percent Mn)	Manganiferous zinc residuum		
1941	73, 852	512, 162	918, 725	282, 049	11, 399	2, 543
1942	177, 966	265, 663	1, 500, 613	292, 051	15, 410	473
1943	195, 096	468, 862	1, 251, 275	270, 328	12, 704	104
1944	241, 170	296, 981	1, 190, 476	247, 402	6, 224	377
1945	174, 295	114, 327	1, 408, 527	224, 331	8, 042	-------

Shipments of various grades of manganese-bearing ores during the last 5 years are given, by States, in the following tables. In addition, battery-grade manganese ore was produced in Montana, and manganiferous zinc residuum was produced from New Jersey zinc ores in 1945.

Metallurgical manganese ore shipped from mines in the United States, 1941–45, by States, in short tons

State	1941	1942	1943	1944	1945	State	1941	1942	1943	1944	1945
Ala	-------	26	-------	49	32	Oreg	85	45	143	-------	-------
Ariz	990	2, 946	5, 779	8, 519	1, 093	Pa	-------	22	-------	-------	-------
Ark	5, 015	4, 132	5, 319	7, 109	6, 663	S. C	-------	-------	312	1, 400	41
Calif	2, 600	10, 112	20, 604	21, 540	1, 668	S. Dak	-------	81	12	-------	-------
Colo	190	513	707	-------	-------	Tenn	4, 394	2, 247	2, 501	418	-------
Ga	4, 893	4, 890	2, 467	1, 135	1, 056	Utah	43	970	91	30	-------
Idaho	34	-------	36	-------	-------	Va	4, 983	11, 024	7, 040	20, 034	8, 566
Mo	12	239	180	-------	-------	Wash	1, 588	10, 660	7, 731	5, 199	6, 994
Mont	43, 555	120, 409	130, 789	153, 665	143, 888	W. Va	2, 458	2, 240	-------	-------	-------
Nev	2, 937	6, 112	10, 451	21, 799	960	Wyo	-------	-------	60	-------	-------
N. Mex	-------	1, 267	469	273	3, 334						
N. C	35	-------	140	-------	-------		73, 852	177, 966	195, 096	241, 170	174, 295
Okla	40	31	265	-------	-------						

[2] Julihn, C. E., and Moon, Lowell B., Summary of Bureau of Mines Exploration Projects on Deposits of Raw Material Resources for Steel Production: Bureau of Mines Rept. of Investigations 3801, 1945, 35 pp.

Ferruginous manganese ore shipped from mines in the United States, 1941–45, by States, in short tons

State	1941	1942	1943	1944	1945	State	1941	1942	1943	1944	1945
Ala	------	206	------	------	------	N. Mex	65,483	89,009	72,967	100,683	85,744
Ariz	17	------	498	320	56	N. C	174	------	115	------	------
Ark	3,381	14,067	8,207	14,755	14,806	Okla	56	------	------	------	------
Calif	464	4,659	8,492	4,598	12	S. C	------	------	155	171	------
Colo	------	44	------	------	47	Tenn	1,865	916	803	6,779	1,000
Ga	6,715	10,514	5,835	2,232	------	Tex	------	142	------	------	------
Idaho	390	------	------	------	------	Utah	551	78	18	32,141	5,001
Mass	4,480	3,301	------	------	------	Va	4,375	3,905	12,208	4,419	392
Mich	------	34,643	100,092	------	------	Wash	7	------	------	------	------
Minn	409,855	88,509	253,779	122,765	------	W. Va	448	560	------	------	------
Mont	4,988	15,468	2,041	781	5,057						
Nev	8,913	2,743	6,383	7,492	2,212		512,162	268,764	471,593	297,136	114,327

Manganiferous iron ore shipped from mines in the United States, 1941–45, by States, in short tons

State	1941	1942	1943	1944	1945
Alabama	------	162	------	------	------
Georgia	1,192	------	------	------	------
Michigan	------	------	------	45,689	1,680
Minnesota	917,533	1,500,451	1,251,275	1,144,787	1,406,847
Virginia	------	------	------	------	------
	918,725	1,500,613	1,251,275	1,190,476	1,408,527

MINING BY STATES

Alabama.—The Cobalt Hill mine in Cherokee County supplied the manganese ore from Alabama in 1945, as in 1944; the ore averaged (dry) 39.22 percent Mn.

Arizona.—Shipments totaling 709 short tons were made from the Manganese King mine in Pima County by R. H. Van Morel; the ore averaged (natural) 45 percent Mn. Smaller shipments were made from Long Valley in Coconino County, and from the Victory mine in Yavapai County. The small output of ferruginous manganese ore averaged (natural) 33.6 percent Mn and came from the Black Warrior mine in Mohave County.

The manganese deposits in the Artillery Mountains region are described by Lasky and Webber.[3]

Arkansas.—All of the ore produced in Arkansas during 1944 came from mines in Independence County; the Southern Hill mine, operated by Davis Mining Enterprises and R. B. Potashnick, was the largest producer. Shipments of ferruginous ore were made by the Walter H. Denison Manganese & Contracting Co., Inc., the Arkansas Manganese Co., C. C. Sims, and the Office of Metals Reserve. The ferruginous ore averaged 19 percent Mn and was shipped to blast furnaces in the Birmingham, Ala., district; the ore shipped by the Office of Metals Reserve was mined before 1945 but was not included in shipments in earlier years, as it was originally stock-piled for concentrating.

California.—Shipments of manganese ore from California mines in 1945 amounted to only 1,668 tons—the lowest since 1940; 10 shippers contributed compared with 56 in 1944.

[3] Lasky, S. G., and Webber, B. N., Manganese Deposits in the Artillery Mountain Region, Mohave County, Ariz.: Geol. Survey Bull. 936-R, 1944, pp. 417–448.

Manganese and manganiferous ores shipped from mines in the United States in 1945, by States

	Metallurgical				Battery				Total			
	Shippers	Short tons: Gross weight	Short tons: Manganese content	Value	Shippers	Short tons: Gross weight	Short tons: Manganese content	Value	Shippers	Short tons: Gross weight	Short tons: Manganese content	Value
Manganese ore: [1]												
Alabama	1	32	11	(2)					1	32	11	(2)
Arizona	3	1,093	513	$45,521					3	1,093	513	$45,521
Arkansas	5	6,663	2,794	228,476					5	6,663	2,794	228,476
California	10	1,668	849	78,598					10	1,668	849	78,598
Georgia	3	1,056	386	25,387					3	1,056	386	25,387
Montana	2	143,888	85,792	(2)	3	8,042	3,954	(2)	5	151,930	89,746	6,146,595
Nevada	1	960	427	(2)					1	960	427	(2)
New Mexico	1	3,334	1,494	(2)					1	3,334	1,494	(2)
South Carolina	1	41	15	(2)					1	41	15	(2)
Virginia	6	8,566	3,684	307,976					6	8,566	3,684	307,976
Washington	1	6,994	3,472	(2)					1	6,994	3,472	(2)
Total	34	174,295	99,437	(2)	3	8,042	3,954	(2)	37	182,337	103,391	7,320,309
Ferruginous manganese ore: [3]												
Arizona	1	56	19	(2)					1	56	19	(2)
Arkansas	4	14,806	2,769	(2)					4	14,806	2,769	(2)
California	1	12	4	(2)					1	12	4	(2)
Colorado	1	47	16	(2)					1	47	16	(2)
Montana	2	5,057	1,415	(2)					2	5,057	1,415	(2)
Nevada	1	2,212	642	(2)					1	2,212	642	(2)
New Mexico	1	85,744	10,288	(2)					1	85,744	10,288	(2)
Tennessee	1	1,000	137	(2)					1	1,000	137	(2)
Utah	3	5,001	1,289	(2)					3	5,001	1,289	(2)
Virginia	1	392	78	(2)					1	392	78	(2)
Total	16	114,327	16,657	580,391					16	114,327	16,657	580,391
Manganiferous iron ore: [4]												
Michigan	1	1,680	859	(2)					1	1,680	859	(2)
Minnesota	2	1,406,847	96,118	(2)					2	1,406,847	96,118	(2)
Total	3	1,408,527	96,977	2,933,275					3	1,408,527	96,977	2,933,275

[1] Containing 35 percent or more manganese (natural).
[2] Value included in total.
[3] Containing 10 to 35 percent manganese (natural).
[4] Containing 5 to 10 percent manganese (natural).

The largest producer during 1945 was the Irish Hills mine in San Luis Obispo County, which shipped 890 short tons of ore containing (natural) 54.4 percent Mn. Other shipments were made from Alameda, Humboldt, Imperial, Plumas, Riverside, Trinity, San Joaquin, and Stanislaus Counties. The small shipment of ferruginous ore was made from the Old Bill claim in Shasta County.

All purchases of California ore were made by the Office of Metals Reserve during 1945.

Colorado.—The Mohawk Mining Co., Silverton, Colo., shipped a small quantity of ore containing (natural) 33 percent Mn to blast furnaces at Pueblo, Colo., during 1945.

Georgia.—H. M. McKnight, shipping from the Cherokee Mining Co. mine in Lincoln County, was the largest (780 tons) shipper in Georgia during 1945. Neel & Neel and H. S. Simpson shipped the remainder from mines in Bartow County.

Michigan.—Manganiferous iron ore from Michigan was shipped from the Rogers mine stock pile during 1945.

Minnesota.—Shipments of manganiferous ore were made from the Hopkins, Merritt, Louise, Mahnomen, Sagamore, and Hillcrest-Alstead-Arko Group mines on the Cuyuna range, and the Corsica mine on the Mesabi range during 1945. All contained less than 10 percent Mn.

Montana.—Montana shipped 83 percent of both the metallurgical ore and total manganese ore in the United States in 1945. The bulk came from the reduction works of the Anaconda Copper Mining Co. at Anaconda, Mont., using carbonate ore mined at the Anselmo, Emma, and Travona mines at Butte. The flotation-nodulizing plant at Butte, operated by the Domestic Manganese & Development Co., produced 14,094 short tons of nodules averaging 54.47 percent Mn. Battery ore was produced from oxide ore mined at the Moorlight Group and Trout mines in the Philipsburg district.

Nevada.—The Black Diablo mine in Pershing County shipped ferruginous manganese ore containing (natural) 29 percent Mn to the Geneva Steel Co., Geneva, Utah. All of the manganese ore in 1945 and the rest of the ferruginous ore from Nevada was shipped from Manganese Mining Co. mine in White Pine County.

New Mexico.—The gravity concentration mill of the United Mining & Milling Co. produced and shipped 3,334 short tons of concentrate averaging (natural) 44.8 percent Mn from Socorro County during 1945. Twelve percent manganese-bearing ore was shipped from the Boston Hill mine in Grant County to blast furnaces at Pueblo, Colorado, by the A. A. Luck Mining Co., Silver City.

South Carolina.—A small shipment of metallurgical ore was made from the Dorn mine in McCormick County during 1945.

South Dakota.—A description of the manganese deposits of Chamberlain and methods of beneficiating these low-grade ores have been presented by Dupuy, Calhoun, and Rasmussen.[4]

Tennessee.—The Minerals Co. of Virginia shipped ferruginous manganese ore averaging (natural) 13.62 percent Mn to the Birmingham, Ala., district.

Utah.—All of the manganese-bearing ore from Utah in 1945 was

[4] Dupuy, Leon W., Calhoun, W. A., and Rasmussen, R. T. C., Mining and Concentration of Missouri Valley Manganese at Chamberlain, S. Dak.: Bureau of Mines Rept. of Investigations 3839, 1946, 103 pp.

ferruginous ore ranging in manganese content (dry) from 18.20 percent to 26.00 percent. Except for very small shipments from one mine each, in Juab and Grand Counties, all came from the Black Boy mine in Juab County, operated by the Ward Leasing Co.

Virginia.—The important producer of manganese ore in Virginia in 1945 was the Dominion Manganese Corp., which produced and shipped 8,299 short tons and 8,154 tons respectively from the Old Dominion mine in Augusta County; the ore averaged (natural) 43.34 percent manganese. The rest of the ore from the State came from properties in Campbell and Smyth Counties.

Washington.—The total output of manganese ore from Washington in 1945 was hausmanite ore from the Crescent mine in Clallam County. The ore averaged (dry) 51.71 percent Mn, 1.66 percent Fe, 9.52 percent SiO_2, and 0.06 percent P.

IMPORTS OF MANGANESE ORE

Imports of battery-grade ore totaled 86,551 short tons in 1945. Of this quantity, 84,445 tons came from Gold Coast and 2,106 tons from U. S. S. R. The ore averaged 55.60 percent Mn or 87.95 percent MnO_2. Imports for consumption of battery ore amounted to 60,447 tons of which 58,341 tons originated in Gold Coast and 2,106 tons in U. S. S. R. Import data for battery-grade ore include the tonnage of ore destined for chemical purposes.

There were no entries of ore containing less than 35 percent Mn in 1945. Imports for consumption of this material (all from Mexico) amounted to 68 tons containing 28 tons of manganese and were valued at $1,078.

The following table gives imports of ore containing over 35 percent manganese.

Manganese ore (35 percent or more Mn) imported into the United States, 1944–45, by countries

Country	General imports [1]				Imports for consumption [2]					
	Short tons				Short tons				Value	
	Gross weight		Mn content		Gross weight		Mn content			
	1944	1945	1944	1945	1944	1945	1944	1945	1944	1945
Australia	(3)		(3)		(3)		(3)		$5	
Belgian Congo	9,053		4,526		14,940		7,544		343,423	
Brazil	170,025	282,086	71,873	119,500	197,399	242,275	88,899	115,916	2,654,089	$3,185,930
Chile	4,289	91,334	2,101	42,699	6,009	91,334	2,885	42,699	123,723	2,553,691
Cuba	467,059	293,572	223,392	140,325	467,059	293,572	223,392	140,325	13,331,608	8,448,860
French Morocco	1,348		786		1,348		786		44,127	
Gold Coast	170,857	273,479	88,811	141,809	159,982	208,700	82,408	108,747	1,812,857	2,013,761
India and Dependencies	222,962	199,122	111,000	99,589	346,824	210,493	172,385	103,586	4,230,934	2,354,018
Mexico	83,122	46,377	36,633	20,638	80,197	51,646	35,610	22,240	1,618,380	1,154,300
New Zealand	539		240		539		240		14,202	
Union of South Africa	28,656	124,630	13,153	57,448	41,358	61,981	19,028	29,544	540,784	1,098,460
U. S. S. R		151,345		70,802		151,345		70,802		4,923,655
United Kingdom	22		20		22		20		5,140	
	1,157,932	1,461,945	552,535	692,810	1,315,677	1,311,346	633,197	633,859	24,719,272	25,732,675

[1] Comprises ore received in the United States during year; part went into consumption, and remainder entered bonded warehouses.

[2] Comprises receipts during year for consumption and ore withdrawn from bonded warehouses during year (irrespective of time of importation).

[3] Less than 1 ton.

CONSUMPTION AND STOCKS OF MANGANIFEROUS RAW MATERIALS

The consumption of manganese ore in 1945 decreased 7 percent from the total of 1,593,098 tons used in 1944. In 1945, 90 percent was of foreign origin, as in 1944. Industrial stocks of manganese ore on December 31, 1945, were 3 percent greater than the 494,872 tons on hand at the end of 1944.

The following table shows actual tons of manganese ore (containing 35 percent or more manganese, natural) and alloys consumed during 1944 and 1945 by type of consumer and stocks at the end of the year.

Consumption of manganese ore and manganese alloys in the United States, 1944–45, and stocks December 31, 1945, gross weight in short tons

	Consumed		In stock Dec. 31, 1945 [1]	
	1944	1945	At plant including bonded warehouses	In bonded warehouses
Manufacturers of manganese alloys and manganese metal:				
Manganese ore:				
Domestic	142,791	135,175	22,485	
Foreign	1,351,267	1,241,321	437,915	171,131
Total manganese ore	1,494,058	1,376,496	460,400	171,131
Ferromanganese:				
High-carbon				
Medium-carbon			44,573	30,277
Low-carbon				
Total ferromanganese			44,573	30,277
Spiegeleisen			9,234	
Silicomanganese			(2)	(2)
Manganese briquets			(2)	
Manufacturers of steel ingots and steel castings: [3]				
Manganese ore:				
Domestic	1,596	1,711	307	
Foreign	7,965	6,525	1,424	
Total manganese ore	9,561	8,236	1,731	
Ferromanganese:				
High-carbon	647,716	576,277	74,915	
Medium-carbon } Low-carbon	20,759	20,075	3,494	
Total ferromanganese	668,475	596,352	78,409	
Spiegeleisen	134,363	124,509	38,193	
Silicomanganese	57,079	54,272	6,139	
Manufacturers of steel castings: [4]				
Manganese ore:				
Domestic	581	204	317	
Foreign	1,356	720	378	
Total manganese ore	1,937	924	695	
Ferromanganese:				
High-carbon	41,822	31,455	6,438	
Medium-carbon } Low-carbon	2,133	1,638	395	
Total ferromanganese	43,955	33,093	6,833	
Spiegeleisen	13,885	10,473	1,658	
Silicomanganese	10,148	9,107	1,800	

[1] Excluding Government stocks.
[2] Included under "Manufacturers of miscellaneous products."
[3] Includes only that part of castings made by companies that also produce steel ingots.
[4] Excludes companies that produce both steel castings and steel ingots.

Consumption of manganese ore and manganese alloys in the United States, 1944–45, and stocks December 31, 1945, gross weight in short tons—Continued

	Consumed		In stock Dec. 31, 1945[1]	
	1944	1945	At plant including bonded warehouses	In bonded warehouses
Manufacturers of pig iron:				
Manganese ore:				
Domestic	222	673	516	
Foreign	16,673	19,460	15,947	
Total manganese ore	16,895	20,133	16,463	
Manufacturers of miscellaneous products:				
Ferromanganese:				
High-carbon	14,455	9,721	3,070	
Medium-carbon, Low-carbon	3,606	2,456	872	
Total ferromanganese	18,061	12,177	3,942	
Spiegeleisen	12,249	13,105	4,186	
Silicomanganese	1,074	963	9,239	3,438
Manganese briquets	4,528	4,689	2,419	
Manufacturers of dry cells:				
Manganese ore:				
Domestic	9,216	7,844	1,107	
Foreign	40,633	50,999	22,702	12,681
Total manganese ore	49,849	58,843	23,809	12,681
Manufacturers of chemicals:				
Manganese ore:				
Domestic	480	74	884	
Foreign	20,318	21,153	4,081	
Total manganese ore	20,798	21,227	4,965	
Grand total:				
Manganese ore:				
Domestic	154,886	145,681	25,616	
Foreign	1,438,212	1,340,178	482,447	183,812
Total manganese ore	[5] 1,593,098	[5] 1,485,859	508,063	183,812
Ferromanganese:				
High-carbon	703,993	617,453	133,757 (High-, Medium-, and Low-carbon)	30,277
Medium-carbon, Low-carbon	26,498	24,169		
Total ferromanganese	730,491	641,622	133,757	30,277
Spiegeleisen	160,497	148,087	53,271	
Silicomanganese	68,301	64,342	17,178	3,438
Manganese briquets	4,528	4,689	2,419	

[1] Excluding Government stocks.
[5] The greater part of the consumption of ore was used in the manufacture of ferromanganese and silicomanganese. Combining consumption of ore with that of ferromanganese and silicomanganese would result in duplication.

The following table shows ores available for consumption in the United States in 1945 without adjustments for changes in consumer or Government stocks.

Indicated consumption of manganiferous raw materials in the United States, in 1945

	Ore containing 35 percent or more Mn		Ore and residuum containing 10 to 35 percent Mn		Ore containing 5 to 10 percent Mn	
	Short tons	Mn content (percent)	Short tons	Mn content (percent)	Short tons	Mn content (percent)
Domestic shipments	182,337	56.7	338,658	14.7	1,408,527	6.9
Imports for consumption	1,311,346	48.3	68	(1)	(2)	(2)
Total available for consumption	1,493,683	49.4	338,726	14.7	1,408,527	6.9

[1] Data not available. [2] Estimated none was consumed.

METALLURGICAL INDUSTRY

The steel industry in 1945 used an average of 13.6 pounds of manganese per short ton of steel produced. Of this consumption, 12.0 pounds were in the form of ferromanganese, 0.6 pound as spiegeleisen, 0.9 pound as silicomanganese, and 0.1 pound as manganese ore used directly. In 1944 the consumption of manganese contained in ferromanganese, spiegeleisen, silicomanganese, and manganese ore amounted to 11.7 pounds, 0.6 pound, 0.9 pound, and 0.1 pound, respectively, per ton of steel.

The above data apply to the consumption of manganese ore in the manufacture of steel ingots and that part of steel castings manufactured by concerns that also produce steel ingots.

Electrolytic manganese.—There are two commercial producers of electrolytic manganese—the Electro-Manganese Corp., Knoxville, Tenn., and the Olympic Mines, Inc., Hoodsport, Wash. The Bureau of Mines, in cooperation with industry, has been active in conducting research to determine the acceptability of this material in ferrous and nonferrous metallurgy. Electrolytic manganese can replace ferromanganese technologically in virtually all uses but shows particular advantage in critical grades of stainless steel, where it is difficult to meet carbon and phosphorus specifications, and in low-carbon steels and ingot irons; the present relatively high cost of this material limits wider acceptance.

Production of electrolytic manganese in the United States, 1939–45, by producers, in pounds

Year	Electro-Manganese Corp.	Bureau of Mines	Total
1939	43,669		43,669
1940	418,837		418,837
1941	1,190,042		1,190,042
1942	1,306,310	149,380	1,455,690
1943	2,385,486	464,690	2,850,176
1944	3,308,071	476,200	3,784,271
1945	3,398,569	280,336	3,678,905
	12,050,984	1,370,606	13,421,590

Ferromanganese.—The domestic output of ferromanganese decreased 12 percent from 1944—from 702,632 tons in 1944 to 619,760 tons in 1945, and was produced at the following plants during the year:

Bethlehem Steel Co., Johnstown, Pa.
E. J. Lavino & Co., Reusens, Va. and Sheridan, Pa.
Sloss-Sheffield Steel & Iron Co., North Birmingham, Ala.
Tennessee Products Corp., Rockwood, Tenn.
U. S. Steel Corp., Ensley, Ala. and Etna and Clairton, Pa.
Electro-Metallurgical Co., Niagara Falls, N. Y., and Alloy, W. Va.

Ten percent of the total manganese ore used in 1945 for the production of ferromanganese was of domestic origin, as in 1944. Based on the relative manganese content of foreign and domestic ore, 12 percent of the ferromanganese was made from domestic ore in 1945. The recovery of manganese from ore in making ferromanganese was 85.62 percent in 1945 compared with 85.76 percent in 1944.

Ferromanganese and spiegeleisen imported into and made from domestic and imported ores in the United States, 1944–45, in short tons

	1944		1945	
	Alloy	Manganese	Alloy	Manganese
Ferromanganese:				
Imported	4, 199	3, 308	35, 521	27, 694
Domestic production	702, 632	552, 429	619, 760	489, 603
From domestic ore [1]	84, 316	66, 291	74, 457	58, 820
From imported ore [1]	618, 316	486, 138	545, 303	430, 783
Total	706, 831	555, 737	655, 281	517, 297
Ratio (percent) of Mn in ferromanganese of domestic origin to total Mn in ferromanganese made and imported		11. 93		11. 37
Number of plants making ferromanganese	(2)		10	
Spiegeleisen:				
Imported	3, 761	[1] 752	3, 146	[1] 629
Domestic production	165, 530	32, 420	139, 039	27, 446
From domestic ore	[1] 164, 563	32, 231	139, 039	27, 446
From imported ore	[1] 967	189		
Total	169, 291	33, 172	142, 185	28, 075
Ratio (percent) of Mn in spiegeleisen of domestic origin to total Mn in spiegeleisen made and imported		97. 16		97. 76
Number of plants making spiegeleisen	(2)		5	
Total available supply of metallic manganese in ferromanganese and spiegeleisen		588, 909		545, 372
Percent of available supply of manganese in—				
Ferromanganese and spiegeleisen imported		0. 69		5. 19
Ferromanganese made from imported ore		82. 55		78. 99
Spiegeleisen made from imported ore		. 03		
Ferromanganese made from domestic ore		11. 26		10. 79
Spiegeleisen made from domestic ore		5. 47		5. 03
Ferromanganese and spiegeleisen made from domestic ore		16. 73		15. 82
Spiegeleisen made and imported		5. 63		5. 15
Total open-hearth, bessemer, and electric steel	89, 641, 575		79, 701, 624	

[1] Estimated. [2] Data not available.

Ferromanganese produced in the United States and metalliferous materials consumed in its manufacture, 1941–45

Year	Ferromanganese produced			Materials consumed (short tons)				Manganese ore used per ton of ferromanganese made (short tons)
	Short tons	Manganese contained		Manganese ore (35 percent or more Mn, natural)		Iron and manganiferous iron ores	Cinder, scale, and purchased scrap	
		Percent	Short tons	Foreign	Domestic			
1941	580, 704	79. 48	461, 539	1, 122, 187	9, 414	5, 166	6, 031	1. 949
1942	661. 338	79. 01	522, 553	1, 273, 596	17, 572	19, 545	4, 634	1. 952
1943	702, 484	78. 98	554, 828	1, 181, 929	199, 567	1, 684		1. 967
1944	702, 632	78. 62	552, 429	1, 224, 878	130, 886	1, 985		1. 930
1945	619, 760	79. 00	489, 603	1, 111, 075	120, 420	5, 364		1. 987

Manganese ore used in manufacture of ferromanganese in the United States, 1941–45 by sources of ore

Source of ore	1941		1942		1943		1944		1945	
	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)	Gross weight (short tons)	Mn content, natural (percent)
Domestic	9,414	41.61	17,572	39.69	199,567	57.86	130,886	59.06	120,420	57.05
Foreign:										
Africa	221,940	47.11	274,450	46.61	340,985	45.21	290,684	46.19	280,264	46.15
Brazil	328,769	42.29	342,538	41.55	254,215	39.72	227,410	41.02	275,117	41.19
Canada	---	---	---	---	44	45.00	---	---	---	---
Chile	4,715	45.81	5,677	46.64	5,837	48.95	464	45.47	5,498	45.42
Cuba	135,581	48.47	171,029	46.33	194,780	45.91	241,582	47.45	257,521	45.37
India	[1] 250,425	49.85	340,096	49.75	255,897	49.10	246,044	49.36	164,568	48.87
Java	---	---	2,189	46.28	---	---	---	---	---	---
Mexico	1,755	46.27	2,013	45.31	10,436	41.03	46,495	41.15	21,791	43.86
New Zealand	---	---	---	---	---	---	536	44.35	---	---
Philippine Islands	6,236	48.32	19,741	46.05	27,233	46.04	8,144	52.00	---	---
U. S. S. R	[1] 145,325	48.12	64,051	48.06	3,129	45.19	---	---	12,452	44.49
Undistributed	[1] 27,441	46.26	[2] 51,812	45.75	[3] 89,373	49.21	[3] 163,519	48.58	93,864	48.59
	1,131,601	46.54	1,291,168	45.99	1,381,496	47.11	1,355,764	46.28	1,231,495	46.43

[1] Tonnage entered under "Undistributed" comprises ore from India and U. S. S. R.; separation as to source not reported by consumer.
[2] Source of ore not reported by consumer.
[3] "Orient" reported by consumer as source of ore.

Shipments of ferromanganese in 1945 decreased 15 percent in quantity and 14 percent in value from 1944. The record of shipments for the past 5 years follows:

Ferromanganese shipped from furnaces in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	619,395	$69,378,004	1944	715,059	$91,406,229
1942	659,219	82,726,298	1945	610,376	78,907,189
1943	722,658	93,481,580			

Imports for consumption of ferromanganese were eight times those of 1944, and exports increased 39 percent.

Ferromanganese imported into and exported from the United States, 1941–45

Year	Imports for consumption			Exports [1]	
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Value
1941	7,032	5,696	$557,150	5,155	$771,575
1942	14,772	11,635	1,274,749	7,165	976,923
1943	2,302	990	160,600	12,510	1,717,888
1944	4,199	3,308	394,641	600	101,445
1945	35,521	27,694	3,733,846	836	175,556

[1] 1941: Includes spiegeleisen; not separately classified before July 1, 1941.

Ferromanganese imported for consumption in the United States, 1944–45, by countries

Country	1944			1945		
	Gross weight (short tons)	Mn content (short tons)	Value	Gross weight (short tons)	Mn content (short tons)	Value
Canada	2,791	2,232	$296,359	35,521	27,694	$3,733,846
India and Dependencies	1,408	1,076	98,282			
	4,199	3,308	394,641	35,521	27,694	3,733,846

Spiegeleisen.—Production of spiegeleisen decreased 16 percent from 1944; shipments increased 2 percent in quantity and 5 percent in value.

Spiegeleisen produced and shipped in the United States, 1941–45

Year	Produced (short tons)	Shipped from furnaces		Year	Produced (short tons)	Shipped from furnaces	
		Short tons	Value			Short tons	Value
1941	177,915	181,177	$5,793,481	1944	165,530	155,325	$4,851,490
1942	186,026	186,163	5,931,728	1945	139,039	157,774	5,108,144
1943	149,036	150,136	4,827,954				

Spiegeleisen was manufactured at the following plants during 1945:

Inland Steel Co., East Chicago, Ind.
New Jersey Zinc Co., Palmerton, Pa.
U. S. Steel Corp., Ensley, Ala., Gary, Ind., and Duquesne, Pa.

In addition to the foregoing plants, shipments were made by E. J. Lavino & Co., Reusens, Va.

All of the spiegeleisen produced in the United States in 1945 was made from domestic raw materials. Imports of spiegeleisen for consumption in 1945 decreased 16 percent in quantity and 7 percent in value from 1944. The total supply came from Canada.

Spiegeleisen imported for consumption in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	4,741	$215,108	1944	3,761	$153,032
1942	1,990	95,853	1945	3,146	142,883
1943	3,254	140,247			

The value of spiegeleisen at producers' furnaces, was $32.38 per short ton compared with $31.23 in 1944.

Manganiferous pig iron.—Pig-iron blast furnaces used 28,766 tons of of manganiferous zinc residuum and a total of 1,175,813 tons of domestic ore containing over 5 percent (natural) manganese in 1945; of this ore, 673 tons contained 35 percent or more manganese, 232,745 tons contained 10 to 35 percent manganese, and 942,395 tons contained 5 to 10 percent manganese. In addition 19,460 tons of foreign ore containing over 35 percent manganese and 800 tons containing 10 to 35 percent manganese were used during the year.

Foreign ferruginous manganese ore and manganiferous iron ore consumed in the United States, 1942–45, in short tons

Source of ore	Ferruginous manganese ore				Manganiferous iron ore			
	1942	1943	1944	1945	1942	1943	1944	1945
Australia					790			
Brazil	9,173							
Cuba	4,777	9,509	1,844					
Mexico				800				
Sweden					990			
	13,950	9,509	1,844	800	1,780			

BATTERY AND MISCELLANEOUS INDUSTRIES

Manganese ore for battery use should have a high content of available oxygen with minimum iron and be relatively free from such metals as arsenic, copper, nickel, or cobalt, which are electronegative to zinc. Chemical ore has a wide range in analyses and a great many uses; the bulk is used in photography (in the manufacture of hydroquinone), in fertilizers, and in coloring agents for paints and ceramics.

Data covering production, imports, consumption, and stocks of such ores are given elsewhere in this chapter.

PRICES

Prices of manganese (except battery and chemical ore) are upon a unit basis, the unit being 1 percent of a long ton or 22.4 pounds of contained manganese. Prices of chemical ore are quoted upon a per-ton basis, with a minimum requirement of manganese dioxide. A duty of one-half cent per pound of contained manganese is imposed on all imported manganese ore except that from Cuba and the Philippine Islands, which enters duty free. Prices as listed by E & MJ Metal and Mineral Markets at the end of 1945 were: (Per long-ton unit of contained Mn, basis 48 percent, subject to premiums, penalties, freight differentials, and other provisions of Office of Price Administration MPR No. 248, as amended) Metals Reserve Company sales prices, effective May 15, 1944—85 cents, based on New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91 cents based on Fontana, Calif., Provo, Utah, and Pueblo, Colo. Chemical grades, per gross ton, coarse or fine, minimum 80 percent MnO_2, Brazilian or Cuban, were quoted at $55 in carloads, $60 to $65 barreled; Javan or Caucasian, 85 percent minimum, at $70 to $75. Domestic, 70 to 72 percent, was quoted at $45 to $50, in carloads, f. o. b. mines.

For sales made on basing points that are also ports of discharge of imported manganese ore, the prices were f. o. b. cars, shipside, at the dock most favorable to the buyer. Selling prices on imported ore included duty.

WORLD PRODUCTION

The following table shows, insofar as statistics are available, the world production of manganese ores from 1938 to 1945 and their average manganese content. Official statistics of the countries are used, supplemented by data from semiofficial and other sources.

Manganese ore produced in principal countries of the world, 1938–45, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	Percent Mn	1938	1939	1940	1941	1942	1943	1944	1945
North America:									
Canada (shipments)	------	------	359	138	------	395	44	------	------
Costa Rica	50	304	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Cuba	36–50+	123,844	102,415	119,852	251,385	249,255	[3] 311,214	[3] 257,864	[3] 198,003
Mexico (metal content)	44	117	27	307	979	11,493	22,945	29,070	18,542
United States:									
Continental (shipments)	35+	25,727	29,777	40,767	79,646	173,043	186,129	224,632	165,412
Puerto Rico (exports)	48–51	1,039	------	------	------	------	------	------	------
South America:									
Argentina [4]	35–38	437	651	710	1,476	1,424	1,500	(2)	(2)
Bolivia (exports)	50	------	500	------	(2)	600	17	(2)	(2)
Brazil	38–50	306,025	257,752	313,391	[5] 437,402	[5] 306,241	[5] 275,552	[5] 146,983	[5] 244,649
Chile	40–50	19,319	12,550	11,620	35,815	71,292	114,074	72,470	(2)
Europe:									
Bulgaria	30–45	1,887	944	2,000	(2)	(2)	(2)	(2)	(2)
Germany	30+	163	386	124	(2)	(2)	(2)	(2)	(2)
Greece	30+	7,075	11,178	(2)	(2)	(2)	(2)	(2)	(2)
Hungary	35–48	22,221	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Italy	34–37	48,282	44,986	50,986	59,773	------	(2)	(2)	15,389
Portugal	35–45	1,008	353	1,059	1,815	6,820	12,611	6,724	8,114
Rumania	30–36	60,256	41,546	(2)	(2)	[6] 35,000	[6] 38,000	(2)	(2)
Spain	40+	1,319	4,711	5,865	9,968	21,268	26,150	30,426	23,793
Sweden	30–50	5,347	5,934	4,600	13,928	(2)	(2)	(2)	(2)
Switzerland	------	(2)	(2)	(2)	1,755	5,772	8,206	5,900	(2)
U. S. S. R.	41–48	2,272,800	(2)	2,800,000	[6] 2,393,000	[7] 1,823,000	(2)	[6] 461,000	[6] 2,251,000
Yugoslavia	32–38	3,759	5,655	(2)	[8] 4,724	(2)	(2)	(2)	(2)
Asia:									
China (exports)	45–46	1,247	1	(2)	(2)	(2)	(2)	(2)	(2)
India:									
British	47–52	983,464	858,220	882,864	798,555	769,423	604,902	(2)	(2)
Portuguese	42–50+	9,478	8,204	6,525	8,111	680	(2)	(2)	(2)
Indochina	------	2,214	2,440	669	(2)	(2)	(2)	(2)	(2)
Iran [9]	45–55	(2)	(2)	2,320	3,270	1,800	(2)	(2)	(2)
Japan	49–51	[6] 80,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	50–55	9,687	12,074	11,569	(2)	(2)	(2)	(2)	(2)
Philippine Islands	35–48	58,143	29,394	52,166	[10] 50,570	(2)	(2)	(2)	(2)
Turkey	30–50	2,186	3,339	460	1,360	3,313	2,687	1,865	(2)
Unfederated Malay States	30	32,483	31,952	11,702	(2)	(2)	(2)	(2)	(2)
Africa:									
Belgian Congo	50+	7,725	------	18,369	30,532	28,984	17,411	2,983	------
Egypt	30+	153,112	119,882	64,912	2,175	8,169	7,079	30	47
Eritrea	80	(2)	100	100	------	------	------	(2)	(2)
Gold Coast	50+	408,452	388,131	442,998	498,881	691,016	[3] 534,362	[3 5] 512,554	(2)
Morocco:									
French	40–50+	86,597	75,389	104,713	50,722	44,273	48,994	27,550	[6] 45,000
Spanish	38	152	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Northern Rhodesia	30–48	2,779	3,018	3,550	4,775	(2)	(2)	(2)	(2)
Portuguese West Africa	50	(2)	(2)	(2)	(2)	(2)	4,000	2,000	(2)
Tunisia	35–40	(2)	50	(2)	106	102	------	313	(2)
Union of South Africa	30–51	551,739	419,697	412,071	445,893	394,445	219,122	106,883	[10] 78,954
Oceania:									
Australia:									
New South Wales	------	221	148	1,024	1,485	793	614	782	(2)
Queensland	------	382	------	387	209	------	(2)	209	(2)
South Australia	------	------	7	10,827	12,138	9,477	5,680	(2)	(2)
New Zealand	------	91	494	996	764	326	518	------	(2)
Papua [11]	------	------	55	198	408	(2)	(2)	(2)	(2)
	------	5,291,000	5,175,000	5,537,000	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed Belgium produces manganese ore, but data of output are not available. Czechoslovakia reports a production of manganese ore, but as it has been ascertained that the product so reported averages less than 30 percent Mn and therefore would be considered ferruginous manganese ore under the classification used in this report, the output has not been included in the table.
[2] Data not available; estimate included in total in 1939 and 1940.
[3] Dry weight.
[4] Shipments by rail and river.
[5] Exports.
[6] Estimate.
[7] Estimate excludes Ukraine.
[8] Croatia only.
[9] Fiscal year ended Mar. 20 of year stated.
[10] January to September, inclusive.
[11] Fiscal year ended June 30 of year stated.

CANADA

The presence of high-grade float manganese ore in the Steep Rock iron-ore deposit [5] has aroused considerable interest, but no commercial production has been reported.

COSTA RICA

The manganese deposits of Costa Rica are on the Nicoya Peninsula, in the province of Guanacaste, on the Pacific coast. Between 1915 and 1920 nearly 32,000 long tons of high-grade ore was shipped to the United States; except for exploratory work, the mines have been inactive since 1920.[6]

CUBA

Production of manganese ore in Cuba decreased 23 percent from 1944. In 1944, production at the Isabelita mine, Oriente Province, by the Cuban-American Manganese Corp. totaled 140,019 long dry tons.

INDIA

Manganese has been mined in many parts of the Indian Peninsula, the most important area being the Central Provinces.[7] Indian deposits are of three main groups—those interbedded with the Archeans, including the gondites, deposits associated with the kodurites, and the lateritoid deposits. The bulk of production is of the gondite type and is distributed through Bibar, Bombay, Central India, Central Provinces, Eastern States, Madras, Madras States, Mysore, and Orissa. The relatively unimportant kodurite type is found in Madras and Orissa. Lateritoid deposits are found in virtually all of the above locations and in Goa and Delgaum.

IRAN

Manganese dioxide is found in lenticular veins of calcite near Shahryar, 40 miles southwest of Teheran.[8] The Iranian Government developed the Robat Karum mine in this deposit before the war to supply manganese to the Karaj Steel Works. A concentrate was produced by hand picking.

MEXICO

The sintering plant of the Lucifer Manganese Co. at Santa Rosalia, Lower California, began operations during the second quarter of 1945. This company is at present the most important producer of manganese in Mexico, not only in quantity, but in grade of product.

At the Concepcion Bay, Mulege, Lower California, manganese operations of the Cia. Manganeso de Mexico, the concentrating plant was completed and operations commenced. At the end of the second quarter of 1945 this plant was closed due to metallurgical difficulties.[9]

The production of manganese ore in Mexico in 1945 decreased 36 percent from 1944.

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[5] The Northern Miner, Manganese Float Runs $45 U. S.: Vol. 30, No. 19, August 3, 1944, pp. 1 and 5.
[6] Roberts, Ralph J., Manganese Deposits in Costa Rica: Geol. Survey Bull. 935-H, 1944, pp. 387–444.
[7] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 2, February 20, 1946, pp. 13–14.
[8] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 4, October 20, 1945, p. 21.
[9] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 5, November 20, 1945, p. 15.

PANAMA

A decree, published in La Estrella de Panama, January 10, 1945, concedes the mining rights for manganese ore in eight deposits in the Porto Bello district of Colon Province to Dr. Robert R. Aleman, as legal representative of Stuart St. Clair of Washington, D. C.

TURKEY

In the past Turkey has produced manganese from as many as 50 mines. However, costs of production and Russian competition made difficult profitable exploitation of these deposits. In 1927 production totaled 11,398 metric tons but dropped to 61 tons in 1928. In 1935 production rose to 15,600 tons but declined to 530 tons in 1937. During 1944 four licensed manganese mines in the Provinces of Ankara, Eskisehir, and Kutahya were in operation; 1,865 tons were produced and 1,970 tons were shipped. Shipments in 1943 were 834 tons, whereas production totaled 2,687 tons.

A considerable amount of prospecting has been done by the M. T. A. (Turkish Mining and Prospecting Institute), which divides deposits of ore into three regions: (1) Those along the Black Sea coast (Alpine formation), (2) those of the southern or Taurus region (Alpine formation), and (3) those of the Central or Asia Minor region (Hersenian formation). There are many deposits in these regions, but they are small. Most of the manganese along the Black Sea coast is high in SiO_2, and although the Turks have prospected intensively near Karabuk they have found only small deposits of commercial ore.

The largest known deposit is northeast of Gocek. At Ovacik an English and German company, Cenub Anadoli Maden Sirketi, developed some deposits, but excessive costs and transportation difficulties forced the company to suspend operations in 1936. The ore in this district is principally pyrolusite and psilomelane, with some rhodochrosite. The manganese content is approximately 30 percent.

The Karabuk Steel Works requires 4,000 to 5,000 metric tons a year of manganese, and because of the difficulty in finding a steady source of supply, the Ministry of Economy has singled out manganese to allow exploitation permits of 5 or 6 years to entrepreneurs and makes the tax only 1 percent of the value of the ore. The M. T. A. and the Ministry of Economy are now encouraging exploitation of the few more promising deposits. Vehbi Koc, the General Motors representative, is now exploiting one deposit of manganese ore at Alibey which has been furnishing 1,000 to 1,500 metric tons of 37-percent ore to Karabuk for 3 years. There are, however, no reserves, and Koc intends to exploit another deposit in the Bregli coal basin, 30 miles from Zonguldak. Sakir Yorulmaz, a Turk interested in many types of mines, has been shipping small quantities of 44-percent manganese ore from deposits near Sazak.

CHROMITE

By Edwin K. Jenckes and Katharine D. Wildensteiner

SUMMARY OUTLINE

SUMMARY

The new supply of all grades of chromite available to industry was 35,000 short tons greater in 1945 than in 1944. The supply from domestic sources (mine shipments) decreased 69 percent, but imports increased 8 percent. Exports, though small, increased markedly over those in 1944.

Salient statistics of chromite in the United States, 1944–45

	1944		1945	
	Short tons	Value	Short tons	Value
New supply:				
Domestic production (shipments)	45,629	$1,668,299	13,973	$532,382
Imports for consumption	848,390	15,924,992	914,765	17,530,293
Total	894,019	[1] 17,593,291	928,738	18,062,675
Distribution:				
Consumption by industry	848,449	(2)	808,120	(2)
Exports	1,019	43,601	12,366	342,114
Additions to stocks [3]	44,551	(2)	108,252	(2)
Total	894,019	[1] 17,593,291	928,738	18,062,675

[1] Revised figures. [2] Not available. [3] Calculated to strike a balance.

Judged by wartime production alone, domestic ore takes on an apparent importance entirely out of proportion to its true position in industry. The actual significance of domestic chromite is revealed by the fact that, of the 339,721 short tons produced in the war period (Office of Metals Reserve purchases, 1941–45), only 65,270 tons (19 percent) have been absorbed by industry, even under the pressure of wartime shortages, because of low quality. It seems worth repeating[1] that the currently known ore bodies cannot be expected to produce significant quantities of readily marketable ores unless and until commercially feasible methods for their utilization are developed.

[1] Jenckes, E. K., and Wildensteiner, K. D., Chromite: Minerals Yearbook, 1944, p. 603.

This problem has been under intensive investigation by Bureau of Mines engineers for a number of years.

Chromite shipped from mines in the United States, 1913–20 and 1938–45

Year	Short tons	Year	Short tons
1913	286	1938	909
1914	662	1939	4,048
1915	3,675	1940	2,982
1916	52,680	1941	14,259
1917	48,973	1942	112,876
1918	92,322	1943	160,120
1919	5,688	1944	45,629
1920	2,802	1945	13,973

GOVERNMENT ACTIONS

Office of Metals Reserve (successor to Metals Reserve Company July 1).—The Office of Metals Reserve purchasing program for domestic chromite, both contract and small-lot purchases, terminated December 31, 1945, and only one chromite purchase depot for small lots (Grants Pass, Oreg.) was in operation after July 1.

Civilian Production Administration (successor to War Production Board November 3).—On August 1, 1945, WPB General Preference Order M–18–a (chromium) and WPB Supplementary Order M–18–a–1 (chromium) were revoked, and the controls on chromium passed to WPB General Preference Order M–21 of May 4, 1945 (as amended). This last order provided that alloy iron and steel (as defined by the order) should not be melted except upon approval by WPB and that producers of alloying materials (whether ferro-alloys or other compounds usable in iron and steel) should file monthly production schedules with the Board.

Order M–21 (iron and steel), as amended, was reissued on August 24, 1945, and provided that the Board might issue, from time to time, directions regulating the production and distribution of alloy steel and iron and ferro-alloys and alloying compounds.

On May 15, 1945, WPB General Allocation Order M–300, Schedule 62 (as amended)—primary chromium chemicals—was issued, which continued allocation control, redefined small-order exemptions, and directed that the users of sodium bichromate who consumed between 450 and 4,000 pounds of that material in April 1945 file a "one-time report" on such use.

Chromium chemicals for domestic consumption were removed from allocation on September 30, 1945, but the supply was not adequate to permit uncontrolled exports.

United States Department of Justice.—On July 16, 1945, the United States Department of Justice announced that 19 companies who were under indictment on charges of price fixing and control of production and distribution of chromic acid, bichromates, and other chemicals entered pleas of nolo contendere and that the fines imposed amounted to $142,500. The original indictments were returned on June 26, 1942.

Office of Price Administration.—On February 12, 1945, the Office of Price Administration issued MPR 575, which permitted the following increase in prices: Dry chromates and bichromates, 50 cents per 100 pounds; chromate and bichromate liquors, 50 cents per 100 pounds for the equivalent weight of sodium bichromate crystals contained; one-bath chromium tanning compounds, 25 cents per 100 pounds; and chromic acid 75 cents per 100 pounds. No price changes for these primary chromium compounds had been authorized since July 1941. The increases were allowed because of admitted increasing costs and decreasing or disappearing profits.

HISTORICAL SURVEY OF SUPPLY

A survey of the relation of domestic production to total supply for 5-year periods from 1891 to 1943 is given in Minerals Yearbook, 1943 (p. 632). The details, in tonnages, for 1941–45 are given in the accompanying table.

Total supply, imports for consumption, domestic production, and consumption of chromite, 1941–45, in short tons

	1941	1942	1943	1944	1945
Total supply	1,129,551	1,094,483	1,088,696	894,019	928,738
Imports for consumption	1,115,292	981,607	928,576	848,390	914,765
Domestic production	14,259	112,876	160,120	45,629	13,973
Consumption by industry	800,290	891,952	964,600	848,449	808,120

DOMESTIC PRODUCTION

The domestic production of chromite in 1945, measured by shipments from mines, declined to 13,973 short tons and was at the lowest point since 1940. Production of chromite in the United States since 1880 has totaled 615,042 short tons, of which 198,312 tons (32 percent) were mined during World War I, 353,887 tons (58 percent) during World War II, and 62,843 tons (10 percent) in peacetime.

As in 1941, only California and Oregon shipped chromite in 1945, the former supplying 69 percent and the latter 31 percent of the total. The average chromic oxide (Cr_2O_3) content of the ore shipped was 46 percent compared to 44 percent in 1944. The increase in average Cr_2O_3 content of domestic ores mined (shipped) in 1945 followed the

Chromite production (shipments) in the United States, 1941–45, by States, in short tons, and number of producers in 1945

State	1941	1942	1943	1944	1945				
					Number of producers	Cr_2O_3, percent			Total
						45.00 and over	35.00 to 44.99	Under 35.00	
Alaska			5,569	1,845					
California	13,419	44,873	62,495	34,715	40	4,015	5,555	37	9,607
Idaho		25							
Montana		65,238	75,691	1,251					
Oregon	840	2,683	16,363	7,818	10	2,002	2,364		4,366
Texas			2						
Washington		57							
Total	14,259	112,876	160,120	45,629	50	6,017	7,919	37	13,973

raising by Office of Metals Reserve of the minimum acceptable content from 35 percent to 42 percent on January 1, 1945.[2]

California.—Of the total shipments of chromite from California in 1945, 70 percent was from Del Norte County, 29 percent from Eldorado, Placer, San Luis Obispo, Shasta, Siskiyou, and Tehama Counties and 1 percent from Butte, Calaveras, Fresno, Humboldt, and San Benito Counties.

The French Hill mine in Del Norte County, owned and operated by Tyson Chrome Mines, Ltd., was the largest source. Shipment of 3,412 short tons of ore averaging 43 percent Cr_2O_3 and 13 percent Fe was made from this property.

Ranking second in quantity of ore shipped was the High Plateau mine in Del Norte County, owned and operated by Eugene R. and Beatrice Brown; 2,974 short tons of ore averaging 52 percent Cr_2O_3 and 11 percent Fe were shipped from this property.

Oregon.—The chromite shipped from Oregon in 1945 was produced in Josephine and Curry Counties, the former furnishing the bulk of the total.

The Oregon Chrome mine in Josephine County, operated by William S. Robertson, was, for the second year, the largest producer in the State. Total shipments of ore amounted to 2,726 short tons averaging 45 percent Cr_2O_3 and 11 percent Fe. It is reported [3] that the operators began diamond drilling the deposit.

Exploration and development.—During 1945 the Bureau of Mines continued its experimental work on the beneficiation [4] [5] of chrome ore by both physical and chemical means and on the production of metallic chromium.

No extensive field work was done by either the Bureau or the Geological Survey during the year.

CONSUMPTION AND USES

In 1945 the consumption of chromite dropped to 808,120 short tons (a decrease of 40,329 tons (5 percent) from the 1944 figure), marking the second successive year of decline from the all-time high of 1943. However, consumption remained at a relatively high level; this is accounted for in part by the fact that large tonnages of stainless steel were required to satisfy the deferred civilian demand. Industry recognizes three grades of chromite—metallurgical, refractory, and chemical—whose designations are descriptive enough to constitute a definition of their use. The accompanying table shows the total consumption of chromite and the tenor of ore consumed by primary consumer groups for 1940–45.

During 1945, the Office of Metals Reserve sold 337,682 short tons of chromite, of which only 16,440 tons was of domestic origin.

Metallurgical chromite specifications normally call for a material containing 48 percent Cr_2O_3 minimum, with a Cr : Fe ratio of 3: 1 or higher, and for hard, lumpy ore. Ore purchased under less exacting

[2] Work cited in footnote 1, p. 605.
[3] Mining World, vol. 7, No. 4, Apr. 1, 1945, p. 84.
[4] Boericke, F. S., and Bangert, W. M., Effect of Variables in Chemical Beneficiation of Chromite Ores: Bureau of Mines Rept. of Investigations 3817, 1945, 26 pp.
[5] Lloyd, R. R., Garst, O. C., Rawles, W. T., Schlocker, J., Dowding, E. P., Mahan, W. M., and Fuchsman, C. H., Beneficiation of Montana Chromite Concentrates by Roasting and Leaching: Bureau of Mines Rept. of Investigations 3834, 1946, 37 pp.

Consumption of chromite and tenor of ore used by primary consumer groups in the United States, 1940–45, in short tons

Year	Total chromite consumed		Tenor of ore (percent Cr_2O_3)		
	Gross weight (short tons)	Average tenor (percent Cr_2O_3)	Metallurgical	Refractory	Chemical
1940	562,915	45.0	50.5	35.8	47.2
1941	800,290	44.3	50.1	34.8	46.3
1942	891,952	43.2	48.5	34.0	44.8
1943	964,600	43.8	48.5	34.0	44.7
1944	848,449	44.1	49.4	34.2	45.7
1945	808,120	43.8	49.1	34.2	45.0

specifications has been used successfully during the war, but it is probable that during normal times only the highest-grade chromite will be used metallurgically. Ferrochrome, the product made from metallurgical ore, finds its way into alloy iron and steel, where it increases hardenability, strength at high temperatures, and resistance to abrasion, corrosion, and oxidation. Chromium is therefore an essential component of high-speed steel, many of the engineering steels, stainless steel, and a large proportion of other corrosion-resistant alloys. An interesting development in stainless steel is the addition of molybdenum to improve resistance to certain types of corrosion.[6] [7] The utility of Ti additions to stainless steels has been studied, and the effect of Ti in Cr-Mn stainless has been described.[8]

A new stainless type of steel which possesses hardenability through heat treatment and is magnetic has been developed.[9] Outstanding instances of the use of chromium in high-temperature alloys in the United States are for gas turbines (including jet-propulsion units) and gas-engine superchargers [10] and in Germany for gas turbines, especially in connection with jet propulsion.[11]

A comprehensive description of the testing of resistance to corrosion, by salt water and salt air, of various materials, including stainless steel and other chromium alloys, is available.[12] Chromium is also used for special-analysis cutting tools and as a constituent of some hard facing alloys.

Chemical-grade chromite should contain a relatively high percentage of Cr_2O_3 to avoid cutting down furnace capacity and should be low in silica to prevent excessive costs for soda ash. The primary chemicals derived from chromite are chromic acid and chromates and bichromates of sodium and potassium. The principal uses for chromium chemicals are listed in the 1944 Minerals Yearbook (p. 610). Much work has been done on surface protection, utilizing

[6] Wheaton, G. S. and Sunderlin, R. S., Materials of Construction in a Metabisulphite Plant: Chem. and Met. Eng., vol. 52, No. 11, November 1945, pp. 231–232.
[7] Product Engineering, Stainless Steels: Vol. 16, No. 2, February 1945, pp. 105–120.
[8] Comstock, C. F., Titanium in Chrome-Manganese Stainless Steel: Iron Age, vol. 156, No. 6, Aug. 9, 1945, pp. 62–66.
[9] American Metal Market, To Discuss Properties of New 18-8 Magnetic Stainless Steel: Vol. 53, No. 40 Feb. 28, 1946, pp. 1, 3.
[10] Evans, C. T., Jr., Wrought Heat-Resisting Alloys for Gas-Turbine Service: Metal Prog., vol. 48, No. 5, November 1945, pp. 1083–1095.
[11] Office of Publications Board, German Iron and Steel Industry, Ruhr and Salzgitter Areas: File 32–119. 1945.
[12] Such, Irwin H., Future Metals: Steel, vol. 117, No. 7, Aug. 13, 1945, pp. 110–113 and 158–159.

various chromium products for surface impregnation with metallic chromium;[13] [14] on chromate finishes;[15] [16] and on chrome plating, porous [17] and nonporous.[18] Platings of porous chromium have been used successfully in Diesel engines to prolong the life of the cylinder bores.[19]

Refractory chromite must be high in Cr_2O_3 plus Al_2O_3, and low in Fe and SiO_2, which lower the softening and melting points of the refractory. Refractory chromite is processed into plastic cement and chrome brick and has been used as chrome-magnesia and magnesia-chrome brick. Chrome refractories are useful in basic open-hearth furnaces, and their use is being extended to arc furnaces.[20]

OFFICE OF METALS RESERVE STOCKS AND SALES

On December 31, 1945, the Office of Metals Reserve had in its possession in the United States 1,004,669 short tons of chromite of all grades, held in central stock piles, at purchase depots, and by agencies. The accompanying table shows gross weight and average analyses of the ore by points of origin and use grade classification.

Stocks of chromite held by Office of Metals Reserve in the United States in central stock piles, and at purchase depots and in hands of agents, by grades, points of origin, and average analysis, on Dec. 31, 1945

Grade and origin	Gross weight (short tons)	Average analysis		
		Percent Cr_2O_3	Percent Fe	Cr : Fe ratio
Metallurgical ore in stock piles:				
48.00 percent Cr_2O_3 and over:				
Foreign:				
Canada	779	48.47	11.52	2.81
Guatemala	187	50.41	12.74	2.66
New Caledonia	10,450	50.87	10.27	3.39
Rhodesia	2,505	49.89	11.40	2.99
Turkey	76,810	49.00	10.82	3.10
U. S. S. R	231,579	52.22	10.10	3.54
	322,310	51.38	10.29	3.46
45.00 to 47.99 percent Cr_2O_3:				
Foreign:				
New Caledonia	4,284	46.31	9.99	3.17
Rhodesia	7,922	47.26	11.31	2.86
U. S. S. R	6,984	47.38	9.60	3.38
	19,190	47.07	10.39	3.10
Domestic	24,522	46.18	11.12	2.84
	43,712	46.58	10.80	2.95

[13] Rudorff, D. W., Chromizing Processes, a Survey of Latest Russian and German Research: Metallurgia, vol. 32, No. 188, June 1945, p. 59; abs. in Metal Prog., vol. 48, No. 4, October 1945, p. 976.
[14] Iron Age, Chromium, Silicon, and Aluminum Impregnation of Steel: Vol. 156, No. 16, Oct. 18, 1945, pp. 58–61.
[15] Thomas, R. M., Chromate Finishes on Zinc, Cadmium, and Magnesium: Metal Prog., vol. 48, No. 4, October 1945, p. 969.
[16] Darrin, Marc, Chromate Corrosion Inhibitors in Chloride Systems: Ind. Eng. Chem., ind. ed., vol. 38, No. 4, April 1946, pp. 368–375.
[17] South African Mining and Engineering Journal, Porous Chrome: Vol. 56, pt. 2, No. 2746, Sept. 29, 1945, p. 113.
[18] Saltonstall, R. B., Improvements in Other Protective Metallic Plates: Metal Prog., vol. 48, No. 4, October 1945, pp. 965–967.
[19] Metal Bulletin (London), No. 2991, May 4, 1945, p. 10.
[20] Dufty, N. F., Construction and Maintenance of Arc Furnace Lining: Steel, vol. 116, No. 6, Feb. 5, 1945, pp. 118–119, 134, 136.

Stocks of chromite held by Office of Metals Reserve in the United States in central stock piles, and at purchase depots and in hands of agents, by grades, points of origin, and average analysis, on Dec. 31, 1945—Continued.

Grade and origin	Gross weight (short tons)	Average analysis		
		Percent Cr_2O_3	Percent Fe	Cr : Fe ratio
Metalluririgical ore in stock piles—Con.				
42.00 to 44.99 percent Cr_2O_3:				
Foreign:				
Cuba	5, 694	44. 45	9. 83	3. 09
Turkey	3, 405	43. 38	9. 60	3. 09
	9, 099	44. 05	9. 75	3. 09
Domestic	48, 843	42. 90	11. 66	2. 52
	57, 942	43. 08	11. 36	2. 62
35.00 to 41.99 percent Cr_2O_3:				
Foreign:				
Sierra Leone	6, 720	39. 20	9. 31	2. 88
Turkey	4, 523	41. 49	9. 23	3. 09
	11, 243	40. 21	9. 29	2. 96
Domestic	52	40. 98	11. 28	2. 48
	11, 295	40. 12	9. 29	2. 96
Total metallurgical ore in stock piles:				
Foreign	361, 842	50. 61	10. 25	3. 38
Domestic	73, 417	43. 99	11. 48	2. 62
	435, 259	49. 49	10. 46	3. 24
Metallurgical ore at purchase depots:				
Domestic	12, 143	(1)	(1)	(1)
Grand total metallurgical ore	447, 402			
Chemical ore in stock piles:				
45.00 to 47.99 percent Cr_2O_3:				
Foreign:				
Transvaal	17, 994	45. 10	18. 91	1. 63
42.00 to 44.99 percent Cr_2O_3:				
Foreign:				
Transvaal	37, 956	44. 08	18. 23	1. 65
Domestic	627	43. 47	18. 24	1. 63
	38, 583	44. 07	18. 23	1. 65
35.00 to 41.99 percent Cr_2O_3:				
Domestic	81, 837	40. 31	17. 84	1. 57
Total chemical ore in stock piles:				
Foreign	55, 950	44. 40	18. 44	1. 65
Domestic	82, 464	40. 33	17. 84	1. 55
	138, 414	41. 98	18. 08	1. 59
Chemical ore at purchase depots:				
Domestic	46, 444	(1)	(1)	(1)
Grand total chemical ore	184, 858			
Refractory ore in stock piles:				
35.00 to 41.99 percent Cr_2O_3:				
Foreign:				
Cuba	162, 477	37. 31	10. 99	2. 31
Less than 35.00 percent Cr_2O_3:				
Foreign:				
Cuba	136, 572	31. 03	12. 39	1. 71
Philippines	13, 377	34. 17	10. 61	2. 20
	149, 949	31. 31	12. 23	1. 75
Total refractory ore in stock piles:				
Foreign	312, 426	34. 33	11. 58	2. 03
Domestic ore in hands of agents (subgrade)	59, 983	(1)	(1)	(1)
Total chromite stored in United States:				
Foreign	730, 218			
Domestic	274, 451			
	1, 004, 669			

[1] Data not available.

Total Metals Reserve sales of domestic chromite during 1945 amounted to 16,440 short tons. The tenor of this domestic ore and concentrates sold was as follows:

Cr_2O_3 content (percent):	Short tons sold
48.00 and over	------
45.00 to 47.99	5,533
42.00 to 44.99	807
35.00 to 41.99	10,100
	16,440

Total sales of chromite by the Office of Metals Reserve (1941 to 1945) are shown in the accompanying table.

Sales of imported and domestic chromite by Office of Metals Reserve, 1941–45, in short tons

Year	Foreign	Domestic	Total
1941	9,697	------------	9,697
1942	105,838	14,598	120,436
1943	158,975	20,068	179,043
1944	319,205	14,164	333,369
1945	321,242	16,440	337,682
	914,957	65,270	980,227

MARKET AND PRICES

The Office of Metals Reserve was the largest purchaser of domestic chromite in 1945, as it has been since November 1941; purchases were discontinued December 31, 1945. The price schedules in effect in 1944 and 1945 are given in the accompanying table.

Office of Metals Reserve price schedules of chromite in effect in 1944 and 1945

	1944	1945
Base price for ore 48 percent Cr_2O_3 and Cr : Fe ratio 3 : 1 per long ton	$52.80	$52.80
Minimum acceptable analysis:		
Cr_2O_3 percent minimum	35	42
Cr : Fe ratio minimum	1½ : 1	2 : 1
SiO_2 percent maximum	--------	10
Premiums:		
For each 1 percent of Cr_2O_3 in excess of 48 percent per long ton	$1.10	$1.10
For each 0.1 in ratio above 3 : 1 not to exceed 3½ : 1 do	$1.50	$1.50
Penalties:		
For each 1 percent Cr_2O_3 below 48 percent down to limiting acceptable analysis do	$1.10	$1.10
For each 0.1 in ratio below 3 : 1 down to 2 : 1 do	$1.50	$1.50
For ratio below 2 : 1 down to 1½ : 1 do	[1] $15.00	--------

[1] Plus $1 per ton for each decrease of 0.1 below 2 : 1.

OPA Maximum Price Regulation 258, which governed commercial transactions, continued in effect during 1945. The price schedule will be found in Minerals Yearbook, 1942 (p. 633).

Prices quoted during 1945 by E&MJ Metal and Mineral Markets for the various grades of chromite are given in the accompanying table.

E&MJ Metal and Mineral Markets price quotations for various grades of chromite in 1945, per long ton

	Cr_2O_3, percent	Cr : Fe ratio	Price
African and Indian	48	2.8 : 1	$41.00
Do	48	3 : 1	43.50
Do	48		31.00
South African: Transvaal	44		27.40
Do	45		28.30
Do	48		31.00
Do	50		32.80
Brazilian	44	2½ : 1	33.65
Do	48	3 : 1	43.50
Rhodesian	45		[1] 28.30–28.50
Do	48		31.00
Do	48	3 : 1	[2] 43.50–48.50
Domestic	48	3 : 1	[3] 43.50

[1] From Mar. 1 to June 7, $28.50; rest of year, $28.30.
[2] From Mar. 8 to June 7, $48.50; rest of year, $43.50.
[3] Less $7 per ton freight allowance.

FOREIGN TRADE [21]

Imports of chromite in 1945 were 914,765 short tons, an increase of 66,375 tons (8 percent) over those in 1944. Imports in 1942, 1943, and 1944 showed successive declines from the record figure of 1941.

Chromite imported for consumption in the United States, 1941–45, by countries

Country	Gross weight (short tons)				1945		
					Short tons		Value
	1941	1942	1943	1944	Gross weight	Cr_2O_3 content	
North America:							
Canada	393	13,705	17,046	20,296	3,726	1,804	$121,253
Cuba	179,944	137,826	310,729	349,059	297,820	103,482	3,587,556
Guatemala			2,001	1,016	181	81	2,759
	180,337	151,531	329,776	370,371	301,727	105,367	3,711,568
South America: Brazil	6,005	6,468	9,285	4,278	2,920	1,272	51,281
Europe:							
Cyprus			8,400				
Greece	2,199						
U. S. S. R.		30,061	99,922	112,315	166,142	86,378	7,271,159
	2,199	30,061	108,322	112,315	166,142	86,378	7,271,159
Asia: [1]							
India and Dependencies	10,910	21,316	2,800				
Philippine Islands	288,411	30,475					
Turkey	61,845	[1] 119,548	90,778	98,777	70,845	34,829	1,708,768
	361,166	171,339	93,578	98,777	70,845	34,829	1,708,768
Africa: [1]							
British West Africa					6,397	2,751	97,104
Sierra Leone	16,464						
Southern Rhodesia	269,210	277,272	243,508	187,781	221,855	104,048	2,948,538
Union of South Africa	189,703	262,259	111,602	40,376	110,415	48,265	1,056,565
	475,377	539,531	355,110	228,157	338,667	155,064	4,102,207
Oceania:							
Australia					73	26	1,250
New Caledonia [2]	90,208	82,677	32,505	34,492	34,391	17,806	684,060
	90,208	82,677	32,505	34,492	34,464	17,832	685,310
	1,115,292	981,607	928,576	848,390	914,765	400,742	17,530,293

[1] For change in presentation of data for 1942 and following years, see Minerals Yearbook, 1943, p. 634.
[2] Listed as French Oceania by U. S. Department of Commerce.

[21] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

The only importations of ferrochrome were from Canada and totaled 6,371 short tons having 4,292 tons chromium content. Chromates were imported aggregating 600 short tons.

Exports of chromite were 12,366 short tons, of which 12,116 tons went to Canada, 230 tons to Mexico, 18 tons to Cuba, and 2 tons to Curaçao.

Exports of ferrochrome were 1,471 tons, of which 1,347 tons went to Canada and 23 tons of chromium metal, alloys and scrap were exported. Exports of salts and compounds were 159 tons.

WORLD PRODUCTION

World production of chromite, 1939–45, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1939	1940	1941	1942	1943	1944	1945
North America:							
Canada		304	2,152	10,393	26,848	24,543	5,136
Cuba	59,562	52,347	163,175	286,470	354,152	192,131	172,626
Guatemala	564	136	697	529	374	97	442
Mexico	(1)	(1)	12	17			(1)
United States	3,672	2,705	12,935	102,400	145,259	41,394	12,676
South America:							
Argentina			60	210	36	(1)	(1)
Brazil (exports)	3,554	4,572	5,944	5,776	7,813	4,721	1,490
Europe:							
Albania	3,070	[2] 14,000	[3] 20,000	[2] 5,000	(1)	(1)	(1)
Bulgaria	4,251	6,000	(1)	[2] 6,500	[2] 7,000	(1)	(1)
Greece	57,091	57,000	(1)	[2] 40,000	[2] 15,000	(1)	(1)
Norway	371	(1)	(1)	(1)	(1)	(1)	(1)
Portugal					1,267	1,500	(1)
United Kingdom (shipments)	(1)	[2] 1,200	(1)	[2] 500	[2] 500	(1)	(1)
Yugoslavia	59,527	71,019	(1)	[2] 100,000	[2] 65,000	(1)	(1)
Asia:							
Cyprus (exports)	1,118	2,540	4,816	2,936	7,986	469	1,070
India	49,925	56,402	50,940	50,380	33,789	(1)	(1)
Iran					[4] 435	[4] 1,267	(1)
Japan	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Philippine Islands (exports)	126,749	194,393	[2] 300,000	[2] 50,000	[2] 60,000	(1)	(1)
Turkey	191,644	169,823	150,303	144,704	196,836	184,573	[2] 70,000
U. S. S. R.	(1)	(1)	(1)	[5] 400,000	[2] 325,000	(1)	(1)
Africa:							
Egypt				312	910	150	150
Sierra Leone	10,755	17,777	[6] 15,131	[2] 15,000	16,305	9,835	(1)
Southern Rhodesia	139,083	247,724	323,935	348,314	287,453	277,051	186,318
Union of South Africa	160,014	163,646	141,884	337,620	163,232	88,909	[7] 59,816
Oceania:							
Australia:							
Queensland						1,125	(1)
New South Wales	118	279	356	365	412	246	(1)
New Caledonia	52,000	55,790	64,509	67,610	46,952	55,229	40,826
Total world production [2]	1,163,000	1,458,000	1,835,000	1,973,000	1,761,000	(1)	(1)

1 Data not available, estimate included in total except for the years 1944 and 1945.
2 Estimate.
3 Estimate may include some production in Yugoslavia.
4 Fiscal year ended March 20 of year stated.
5 Planned production.
6 Exports.
7 January to September, inclusive.

It is to be noted in the table above that production figures are presented for Southern Rhodesia in place of the export figures given in Minerals Yearbook, 1944 (p. 612).

Australia.[22]—Australian production of chromite has been small, reaching a high point of 1,371 metric tons in 1944. Numerous deposits

22 Bureau of Mines Foreign Minerals Survey, The Mineral Industry of Australia: Vol. 2, No. 3, March 1945, pp. 75–78.

are known in New South Wales, Queensland, Western Australia, and Tasmania, but little metallurgical-grade ore has been developed, although proper concentration might produce a small tonnage. The Australian ore is largely refractory grade. The 1942 requirements were substantially 10,000 tons of metallurgical and 5,000 tons of refractory grade. Imported ores and concentrates were smelted for the production of ferrochrome by Broken Hill Proprietary Co., Ltd. (the only consumer in 1942), at its Newcastle plant. This company and the Newbold General Refractories, Ltd., were the major consumers of refractory-grade ore.

Ores are imported from South Africa, Rhodesia, and New Caledonia.

Brazil.—A new company, the Companhia Minas E Exploracão de Reservas Metalicas, called "Merm," has been formed which owns deposits of chromite and other minerals in the States of Bahia, Goiaz, and Minas Gerais. A chrome refractory plant to supply 1,800 tons a year and a chemical plant with a capacity of 2,000 tons of chrome chemicals are planned. Concentrates are to be supplied to the local steel industry.

Cuba.—Production in 1945 was 11,014 metric tons of metallurgical- and 161,612 tons of refractory-grade chromite. Exports were substantially below production, and by December 31 stocks rose to virtually 50,000 tons. United States Government purchases of Cuban chromite ceased in 1945.

Cyprus.[23]—There are two chromite mines in Cyprus, the Troodos mine of the Cyrpus Chrome Co., Ltd., which has been noted in previous Minerals Yearbooks,[24] and the Louveras mine of the Cyprus Mineral Co., which is in the development state.

Egypt.—Chromite has been produced on a small scale; several deposits have been opened, but costs are very high. The high cost of many materials—among them chromium salts—has led the Government to undertake a program of geological mapping of unexplored regions, to initiate a road-building program to serve the Eastern Desert, and to remove restrictions that have prevented the opening of known deposits of chromite, nickel, wolfram, and other minerals.[25]

France.[26]—Importations of chromite and chrome chemicals are given in Statistique mensuelle du commerce extérieur de la France for the immediate prewar years as follows, in metric tons:

	Chromite	*Chrome chemicals*
1935	34, 723	12, 484
1936	46, 823	11, 827
1937	38, 121	10, 146
1938	40, 179	9, 134

Importations from French colonial possessions (included above) were: 1935, 4,557 tons; 1936, 7,050 tons; 1937, none; 1938, 3,305 tons. The article states that the New Caledonian production can supply French chromite requirements and that other sources in French colonial possessions are capable of development.

23 Mining Journal (London), vol. 226, No. 5762, Jan. 26, 1946, p. 69; and No. 5765, Feb. 16, 1946, p. 126.
24 Ridgway, Robert H., Chromite: Minerals Yearbook, 1936, p. 453; Minerals Yearbook, 1937 (Review of 1936), p. 639; Minerals Yearbook, 1938 (Review of 1937), p. 547; Minerals Yearbook, 1939 (Review of 1938), p. 600; Minerals Yearbook, 1940 (Review of 1939), p. 600.
25 Holman, —, Notes on the Mineral Wealth of Egypt: Min. Jour. (London), vol. 225, No. 5753, Nov. 24, 1945, pp. 798–799.
26 Demassieux, N., Le Chrome dans le monde: Chim. et ind., vol. 55, No. 1, January 1946, pp. 58–64.

Germany.—In the course of World War II, nickel was the first alloying element to become scarce in Germany, and substitutions of Cr–Mo and Cr–V–Mo steels were made for Ni-containing steels. The subsequent shortage of Mo forced the adoption of Cr–V and Mo–V steels, and the following shortage of Cr resulted in the use of Mn–V and Mn–Si steels as a measure to conserve Cr for essential uses, such as high-speed steel and corrosion- and heat-resisting steels and other alloys to serve the same purposes. A small quantity of chromium was used for catalysts in the high-pressure synthesis of hydrocarbons.[27]

Greece.[28]—The four principal producers of chromite in Greece are Société Union Minière (mine at Xinca), A. Apostolidas (mine near Isagli), S. Papassotirious (Burinos mine near Kozani), and P. Vryonis (Vavdos mine near Salonika in Macedonia).

The most recent available export statistics (in metric tons and by countries of destination) are:

	1939	*1940*
Germany	22, 278	1, 449
United States	14, 080	26, 281
United Kingdom	11, 255	3, 427
Belgium	1, 767	1, 300
Holland	607	------
Others	2, 373	661
	52, 360	33, 118

India.—Chromite has been found in the Kistna and Salem districts of the Madras Presidency. A small production has come from the Kistna district, and the reserves in the Salem district are reported to be extensive.

During World War II the Tata Iron & Steel Co. developed methods for manufacturing alloy steels and was successful in producing such specialties as tool steels, special alloy steel (armor plate), and Cr–Mo–Ni steels.[29]

New Caledonia.—A comprehensive article by Demassieux [30] states that, in addition to the well-known chromite mines [31] in the north of the island, several less-extensive deposits are found in the southern part near Nouméa, of which Alice-Louise is the most important. The paper presents figures for New Caledonian production for 1900–1938, exports for 1929–1938 with countries of destination, and other valuable data.

Philippine Islands.[32]—During the early stages of the Japanese invasion of the Philippines, American engineers did as much sabotaging as possible—burning oil and supplies, and caving and flooding mines. During their occupation the Japanese exploited what mines they were able to operate and left many mines in worse shape than when they found them, although it is reported that nothing was done

[27] Faragher, W. F., and Horne, W. A., Manufacture and Regeneration of Catalysts at I. G. Farbenindustrie Ludwigshafen/Oppau: Bureau of Mines, March 1946, 6 pp. (Technical Field Information Agency, *Final Report 422.*)

[28] Bureau of Mines Mineral Trade Notes, vol. 22, No. 2, Feb. 20, 1946, p. 4.

[29] Mining Journal (London), Wartime Developments of Alloy Steels in India: Vol. 224, No. 5760, Jan. 12, 1946, p. 24.

[30] Work cited in footnote 26.

[31] Betz, Frederick, Jr., Chromite: Minerals Yearbook, 1942, p. 643.

[32] Lindenau, E. M., Effects of War on Philippine Mining: Min. Jour., vol. 29, No. 11, Oct. 30, 1945, pp. 5–6; vol. 29, No. 13, Nov. 30, 1945, pp. 4–5; vol. 29, No. 15, Dec. 30, 1945, pp. 5–7, 30.

at the Masinloc mine [33] and that the property of the Acoje Mining Co. is in good shape.[34]

The mining industry has been second in importance to sugar in the Philippines and may assume first place if exports of that commodity to the United States should be curtailed after independence. Chromite occupied fourth place in the major minerals produced in the Islands in 1939.

Portugal.[35]—Exports of chromite to Spain from the mines near Braganza were 1,700 metric tons in 1945.

Spain.—Ferrochrome is produced in Spain, apparently from imported Portuguese ores. One steel company, S. A. Echevarria, Bilbao, is known to specialize in tool and alloy steels. In 1944 the domestic consumption of alloy steel was virtually 13,500 metric tons.

Sweden.[36]—In 1945 imports of chromite were 13,155 metric tons.

Turkey.—Turkish production figures for 1944 are now available and place the tonnage for that year at 184,573 metric tons. British and American (Government) purchases ceased on January 1, 1945, and the year's production is expected to be less than that for 1944. The production of the Guleman mines in 1945 was 70,000 tons, an increase of 3,000 tons over 1944.

M. T. A. (the Mine Prospecting and Research Institute) has reported the discovery of 164 chrome deposits since its inception in 1935.

Union of South Africa.[37]—The Union's chromite deposits are situated chiefly in the Lydenburg and Rustenburg districts. The former originates along the upper reaches of the Dwars River, crosses the Steelpoort River near Steelpoort Station, and bends gradually northwestward to Malipsdrift on the Olifants River, a distance of 70 miles. The Rustenburg deposits extend virtually 100 miles from Brits to Rustenburg and thence northward almost to the Crocodile River. Some chromite is found in Northern Transvaal and Natal, and some ore has been shipped from the latter Province.

In the Rustenburg deposits the chromite is associated with anorthosite and pyroxenite, while in the Lydenburg deposits it occurs usually with pyroxenite. Titaniferous magnetite is sometimes found with the chromite in the Bushveld Complex. In Northern Transvaal and Natal the chromite is associated with ancient schistose rocks.

U. S. S. R.—Large mineral-resource developments are claimed to be the result of intense and systematic geological examinations instituted by the Central Government.[38] It is reported [39] that the Urals occupy one of the first places in the world in chromium deposits. In Aktiubinsk [40] a plant has been installed for the production of ferroalloys.

United Kingdom.—Imports of chromite into the United Kingdom have been [41] 37,638 tons in 1938, 93,770 tons in 1944, and 50,768 tons in 1945.

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33 Work cited in footnote 1, p. 616.
34 Bureau of Mines, Mineral Trade Notes, vol. 21, No. 6, Dec. 20, 1945, p. 7.
35 Bureau of Mines, Mineral Trade Notes, vol. 22, No. 4, Apr. 20, 1946, p. 6.
36 Metal Bulletin (London), No. 3080, Mar. 22, 1946, p. 3.
37 South African Mining and Engineering Journal, The Union's Chrome and Platinum: Vol. 56, pt. 2, No. 2746, Sept. 29, 1945, pp. 95, 97.
38 Mining World, Minerals Resource Development in Soviet Russia: Vol. 7, No. 8, July 1945, pp. 19–21.
39 Akimov, M., Natural Wealth of the Soviet Urals: Min. Jour. (London), vol. 226, No. 5772, Apr. 6, 1946, pp. 265–266.
40 Undasynov, N., The Metals of Kazakhstan: Min. Jour. (London), vol. 225, No. 5753, Nov. 24, 1945, p. 802.
41 Metal Bulletin (London), No. 3076, Mar. 8, 1946, p. 3.

NICKEL

By Hubert W. Davis

SUMMARY OUTLINE

SUMMARY

Nickel was the least abundant of the major ferrous alloying elements during World War II and one of the first metals placed on a restricted-use basis. Nevertheless, supplies were adequate to meet all war needs. Nickel was consumed at a high rate up to VE-day, after which demand slackened until VJ-day, when, because of the cancellation of war contracts, consumption declined sharply. Nevertheless, 96,252 short tons of nickel (exclusive of purchased and home scrap) were consumed in 1945. Steel mills and ferrous foundries accounted for about three-fifths of the total nickel used in 1945. The continued use of NE (national emergency) steels and the recovery of nickel scrap resulted in a substantial saving in nickel in 1945. The War Production Board removed restrictions on the use of nickel August 20, 1945.

Salient statistics for nickel, 1941–45

	1941	1942	1943	1944	1945
United States:					
Production:					
Primary short tons	660	612	642	988	1,155
Secondary do	5,315	4,142	6,917	4,321	6,483
Imports (gross weight)[1] do	124,130	132,954	141,249	134,932	122,528
Exports (gross weight)[2] do	7,125	7,096	9,464	7,931	3,876
Price per pound[3] cents	35	35	35	35	35
Canada:					
Production short tons	141,129	142,606	144,009	137,299	121,978
Imports do	1,011	499	545	424	762
Exports do	137,595	138,795	135,547	133,599	108,222
World production (approximate) do	179,000	182,000	183,000	180,000	169,000

[1] Excludes "All other manufactures of nickel"; weight not recorded.
[2] Excludes "Manufactures"; weight not recorded.
[3] Price quoted by International Nickel Co. of Canada, Ltd., for electrolytic nickel at New York, in 2-ton minimum lots.

Imports of nickel in all forms were about 9 percent less than in 1944 and 12 percent smaller than in the peak year 1943. Smaller receipts from Canada and New Caledonia were partly offset by much larger supplies from Cuba and the United Kingdom.

Production of nickel in Canada in 1945 was 11 percent less than in 1944. Output continued at a high rate until VJ-day, when a program of curtailment of operations was inaugurated, and by the year end the production of nickel was down to about half of the expanded capacity.

Although much greater than in recent years, the domestic output of primary nickel was, as heretofore, insignificant in 1945.

The St. Louis Smelting & Refining Co., which began production of nickel commercially at its property near Fredericktown, Madison County, Mo., in July 1944, produced 50 percent more nickel in 1945 than in 1944. The complex ore is treated in a flotation mill, which yields a nickel-cobalt concentrate, a lead concentrate, and a copper concentrate containing some lead. The production of nickel-cobalt concentrate was suspended at the close of September 1945.

The Geological Survey published a report on the Spirit Mountain nickel-copper prospect in Alaska.[1]

The Chelan nickel deposit near Winesap, Wash., was described by Patty and Kelly.[2]

PRODUCTION

Domestic production of nickel is small and comprises metals recovered from scrap-nickel anodes, nickel silver, and copper-nickel alloys (including Monel metal), and primary nickel recovered in copper refining and produced from ore and as a byproduct of talc production, as listed in the following table. Domestic primary nickel was recovered in 1945 as a byproduct in copper refining at Baltimore, Md.; Carteret, N. J.; Laurel Hill, N. Y.; Perth Amboy, N. J.; and Tacoma, Wash. Although all the nickel recovered as a byproduct of copper refining is credited as domestic production, some of it is recovered from imported blister copper. Roasted nickel-cobalt concentrate containing about 19 percent nickel and 13 percent cobalt was produced at Fredericktown, Mo., during the first 9 months of 1945. No concentrates containing nickel were recovered as a byproduct of talc production in Vermont in 1945.

Nickel produced in the United States, 1941–45

Year	Primary (short tons)[1]		Secondary[2]	
	Byproduct in copper refining[3]	Other[4]	Short tons	Value
1941	619	41	5,315	$3,720,500
1942	612		4,142	2,899,400
1943	642		6,917	4,841,900
1944	[5] 988	([5])	4,321	3,024,700
1945	[5] 1,155	([5])	6,483	4,538,100

[1] Bureau of Mines not at liberty to publish value.
[2] Nickel recovered as metal and in alloys and salts.
[3] Nickel content of nickel salts and metallic nickel.
[4] Nickel content of concentrates and matte produced from ore and of concentrates produced as byproduct of talc.
[5] Production from "Other" included under "Byproduct in copper refining." Bureau of Mines not at liberty to publish figures.

[1] Kingston, Jack, and Miller, D. J., Nickel-Copper Prospect near Spirit Mountain, Copper River Region, Alaska: Geol. Survey Bull. 943-C, 1945, 9 pp.
[2] Patty, E. N., and Kelly, S. F., A Geological and Geophysical Study of the Chelan Nickel Deposit, near Winesap, Wash.: Amer. Inst. Min. and Met. Eng. Tech. Pub. 1953, 1945, 10 pp.

FOREIGN TRADE [3]

The quantity of nickel imported into the United States in 1945 was 9 percent smaller than in 1944 and 12 percent less than in the peak year 1943. Imports comprised chiefly metallic nickel, matte, and oxide. As heretofore, Canada was the chief source of the imports; it supplied 150,392,339 pounds of metallic nickel, 37,067,200 pounds of Monel matte (averaging 53 to 54 percent nickel and 25 percent copper), 1,656,519 pounds of washed sulfide (averaging 75 percent nickel), and 4,965,965 pounds of oxide. The washed sulfide and virtually all the oxide were refined to nickel, and the Monel matte was refined to Monel metal and other products at the plant of the International Nickel Co., Inc., Huntington, W. Va. About 2,300 short tons of nickel were produced at Huntington from Canadian washed sulfide and oxide in 1945. New Caledonia supplied 11,353,451 pounds of matte that contained 77 to 78 percent nickel; it was shipped to Huntington for refining. About 5,300 short tons of nickel were produced from New Caledonian matte in 1945. Cuba furnished 33,208,880 pounds of oxide, a relatively small part of which was refined at Wilmington, Del., in January 1945. The United Kingdom supplied 6,411,878 pounds of metallic nickel.

The nickel content of the unmanufactured nickel products imported into the United States is estimated at 214,866,000 pounds in 1945, compared with 236,586,000 pounds in 1944.

Exports of nickel comprise largely products manufactured from imported raw materials. Exports of alloys and metallic nickel were substantially less than in 1944 but exports of nickel-chrome electric resistance wire and nickel silver were appreciably greater.

The United Kingdom (2,578,247 pounds), Canada (1,875,922 pounds), and U. S. S. R. (1,247,701 pounds) were the chief markets for nickel, Monel metal, alloys, and scrap in 1945; the U. S. S. R. (7,279,135 pounds), United Kingdom (6,712,461 pounds), and Canada (861,728 pounds) were the chief markets in 1944.

Nickel products (excluding residues) imported for consumption in the United States, 1943–45, by classes

Class	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Unmanufactured:						
Nickel ore and matte	86,971,459	$13,017,158	72,828,746	$11,713,123	50,077,170	$8,223,086
Nickel pigs, ingots, shot, etc	184,042,404	46,272,805	186,104,935	48,144,356	156,804,166	42,813,780
Nickel bars, rods, tubes, etc	1,115,040	352,619	300	598	51	56
Nickel oxide	10,368,220	1,842,114	10,929,012	2,079,897	38,174,845	7,727,872
Manufactured:						
Nickel silver or German silver in sheets, strips, rods, and wire	1,017	273	291	198	408	194
All other manufactures of nickel	(1)	1,493	(1)	551,530	(1)	122,670
	-----------	61,486,462	-----------	62,489,702	-----------	58,887,658

[1] Quantity not recorded.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Nickel products exported from the United States, 1943–45, by classes

Class	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Ore, concentrates, and matte	145,090	$86,762	1,521	$1,005	15	$38
Alloys and scrap containing nickel (including Monel metal)	11,266,777	3,898,669	8,041,351	2,315,944	4,573,476	1,502,874
Metal in ingots, bars, sheets, etc	6,559,228	3,006,809	6,892,221	3,011,097	1,614,045	740,088
Manufactures	(1)	1,029,966	(1)	1,249,340	(1)	824,322
Nickel-chrome electric resistance wire	598,059	846,221	477,476	793,052	971,549	1,384,044
Nickel silver or German silver, crude, scrap, or bars, rods, etc	182,625	127,588	104,539	56,287	267,145	68,972
Nickel salts and compounds	176,820	67,676	345,682	124,651	326,749	105,469
	------------	9,063,691	------------	7,551,376	------------	4,625,807

1 Quantity not recorded.

CONSUMPTION AND CONSUMERS' STOCKS

The following tables give data on consumption and consumers' stocks of nickel. The data cover all known consumers of nickel in the form of primary, secondary, oxide, and cobalt-nickel compound. The figures for nickel salts, however, fall short of the total; nevertheless, they cover almost all of the larger and many of the smaller users of nickel in this form.

Nickel (exclusive of purchased and home scrap) consumed in the United States in 1945 and stocks at consumers' plants on Dec. 31, 1944 and 1945, by forms, in pounds of nickel

Form	Stocks at consumers' plants Dec. 31, 1944	Consumption in 1945	Stocks at consumers' plants Dec. 31, 1945	In transit to consumers' plants Dec. 31, 1945
Primary	11,180,467	153,235,789	13,386,772	566,383
Secondary (remelted from scrap)	1,909,384	7,906,606	2,976,386	2,000
Oxide	213,942	11,035,457	1,359,466	230,375
Matte	3,383,004	19,809,007	3,409,699	------------
Mayari iron ore	268,975	100	262,125	------------
Nickel-cobalt compound	947	8,681	3,569	------------
Salts	256,641	509,108	367,250	228
	17,213,360	192,504,748	21,765,267	798,986

Nickel (exclusive of purchased and home scrap) consumed in the United States in 1945, by uses

Use	Pounds of nickel
Ferrous:	
Steel (including heat and corrosion resisting alloys and high-iron alloys)	111,114,967
Cast iron	6,025,564
Nonferrous (comprises copper-nickel alloys, nickel silvers, brass, bronze, and aluminum alloys, and Monel, Inconel, and malleable nickel)	52,802,013
High temperature and electrical resistance alloys	7,902,392
Electroplating (anodes and solutions)	12,736,349
Catalysts	890,253
Ceramics	43,042
Other	990,168
	192,504,748

GOVERNMENT STOCKS

Stocks of nickel held by the Office of Metals Reserve on December 31, 1945, totaled 37,911,675 pounds of contained nickel and comprised 854,000 pounds in Burma speiss, 1,339,665 in nickel-cobalt concentrate and matte, 19,080,154 in oxide, 4,045 in hydroxide, 153,983 in Moroccan ore, and 16,479,828 in refined nickel.

WORLD PRODUCTION

The following table shows world production of nickel by countries, 1937–45, insofar as statistics are available.

World production of nickel (content of ore), 1937–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945
Australia	--------	20	--------	(2)	(2)	(2)	--------	--------	--------
Brazil	104	375	25	(2)	(2)	1	--------	6	(2)
Burma	1,233	959	921	(2)	(2)	(2)	(2)	(2)	(2)
Canada	[3] 102,015	95,514	102,559	111,383	128,029	129,369	130,642	124,555	110,656
Cuba	--------	--------	--------	--------	--------	(2)	2,430	4,679	10,900
Egypt	14	33	--------	--------	--------	--------	--------	--------	(2)
Germany	890	550	500	729	674	577	(2)	(2)	(2)
Greece	957	1,207	1,336	(2)	(2)	(2)	300	(2)	(2)
Iran	--------	--------	--------	[4] 21	[4] 9	[4] 7	(2)	(2)	[4] 5
Italy	68	[5] 150	[5] 100	[5] 87	[5] 91	(2)	(2)	(2)	(2)
Morocco, French	132	163	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	--------	[5] 500	[5] 753	2,222	(2)	(2)	(2)	(2)	(2)
New Caledonia	11,600	11,700	10,625	10,535	10,395	9,415	7,374	8,115	4,328
Norway	877	1,245	1,106	1,007	907	911	577	529	(2)
Southern Rhodesia	4	76	[5] 490	(2)	(2)	(2)	(2)	(2)	(2)
Union of South Africa	--------	44	398	416	375	358	899	(2)	(2)
U. S. S. R. (estimate)	2,000	2,500	(2)	8,650	(2)	(2)	11,160	(2)	13,400
United States [6]	199	377	357	503	599	555	582	896	1,048
Total (estimate)	120,100	115,500	122,000	140,000	162,000	165,000	166,000	163,000	153,000

[1] In addition to countries listed Finland, Japan, and Sweden produce nickel, but data of output are not available.
[2] Data not yet available; estimate included in total.
[3] Excludes small quantity produced in British Columbia.
[4] Fiscal year ending Mar. 20 of year stated.
[5] Estimate.
[6] Byproduct in electrolytic refining of copper. In 1941 includes also production from ore and as byproduct of talc; in 1944 and 1945 includes also production from ore.

Canada.—Virtually all the Canadian output is derived from copper-nickel ores of the Sudbury district, Ontario. Some nickel is also recovered as a byproduct from silver-cobalt ores of Cobalt and other areas in northern Canada. Two companies—International Nickel Co. of Canada, Ltd., and Falconbridge Nickel Mines, Ltd.—are the principal producers. Nickel production in Canada was 121,978 short tons in 1945 compared with 137,299 tons in 1944.

According to the International Nickel Co. of Canada, Ltd.:[4]

> The cessation of hostilities in the summer of 1945, followed by the cancellation of war contracts, caused a sharp decline in deliveries of our metals and an accumulation of nickel stocks. As all of our plants were equipped for sufficient output to fulfill the maximum wartime demands of the United Nations, it became necessary to inaugurate a program of curtailment of operations. This was commenced in August and by the year end the production of nickel was down to about 50 percent of the expanded capacity.

[4] International Nickel Co. of Canada, Ltd., Annual Report: 1945, p. 4.

The war years imposed an extraordinarily heavy drain on the ore reserves of the Company and the annual tonnage of ore mined greatly exceeded that of any prewar year. The ore mined in 1943, 1944 and 1945 was 12,105,545 short tons, 12,117,567 short tons and 10,136,350 short tons, respectively. This compares with an average yearly output of 5,321,634 short tons for the three prewar years 1936, 1937 and 1938.

It has nevertheless been possible through our extensive diamond drilling and exploration program to make great progress in the replenishment of proven ore reserves. In spite of the tremendous tonnage of ore removed from the mines during the war years, the proven ore reserves at the end of 1945 stood at 217,-373,000 short tons containing 6,866,000 tons of nickel-copper, compared with 212,368,000 short tons at the end of 1938 containing 6,806,000 tons of nickel-copper.

The underground development in 1945 totaled 50,701 feet, compared with 66,104 in 1944. This brings the total footage of underground development to 1,136,045 at the year end.

Sales of nickel in all forms by the International Nickel Co. of Canada, Ltd., were 201,572,987 pounds in 1945, compared with 250,740,110 and 270,498,674 pounds, respectively, in 1944 and 1943.

Because of a shortage of labor to mine ore, Falconbridge Nickel Mines, Ltd.,[5] was forced to close the smaller of its two furnaces at the end of June 1945; consequently, both the tonnage of ore treated and of metal produced declined substantially from the all-time peak established in 1944. Ore treated in 1945 totaled 716,868 short tons (830,254 tons in 1944) and comprised 422,679 tons of milling ore and 294,189 tons of smelting ore. The ore treated averaged 1.596 percent nickel in 1945 (1.59 percent in 1944). Matte produced in 1945 contained 10,349 tons of nickel (12,049 tons in 1944). Ore reserves were 13,682,000 tons averaging 1.72 percent nickel on December 31, 1945.

Shortly after hostilities in Europe ceased, part of the production of matte by Falconbridge Nickel Mines, Ltd., was diverted to its Kristiansand, Norway, refinery, which during the period of occupation of Norway had been operated under German control. By late November the entire output of matte was being shipped to Kristiansand.

Cuba.—Production of nickel in Cuba in 1945 was more than double that of 1944; as a consequence it surpassed New Caledonia as a producer. The ore is converted to oxide at the plant of Nicaro Nickel Co. at Lengua de Pajaro, from which it is exported to the United States, where it is sold to the steel industry. However, during the latter half of 1944 and January 1945 some of the oxide was refined at Wilmington, Del. Production of nickel oxide was 15,425 short tons (12,015 tons nickel content) in 1945 compared with 6,902 tons (5,158 tons nickel content) in 1944. Exports of nickel oxide from Cuba were 16,326 short tons (12,625 nickel content) in 1945 compared with 4,435 tons (nickel content not stated) in 1944. The mine and metallurgical plant of Nicaro Nickel Co. have been described by Baragwanath and Chatelain.[6]

According to the Freeport Sulphur Co., of which the Nicaro Nickel Co. is a subsidiary:[7]

Nicaro Nickel Company has continued to operate the nickel mining and recovery plant at Nicaro, Cuba. This plant is owned by Reconstruction Finance Corporation and is operated by us with funds supplied by that agency. * * * During 1945 steady and substantial progress was made in the production of nickel oxide,

[5] Falconbridge Nickel Mines, Ltd., 17th Annual Report: 1945, pp. 1-11.

[6] Baragwanath, J. G., and Chatelain, J. B., Development and Equipment of the Nicaro Nickel Project: Min. and Met., vol. 26, No. 464, August 1945, pp. 391-394.

[7] Freeport Sulphur Co., 33d Annual Report: 1945, pp. 5-6.

and the steel industry has widely accepted the product and given the project its wholehearted support. For the last half of the year the plant was producing at a rate equivalent to approximately 30 percent of the prewar United States consumption of this strategic material for which this country has been almost entirely dependent upon foreign sources. It is very gratifying to be able to report that operations in this period were on a basis which permitted a profit to Reconstruction Finance Corporation on its sales of our current production, there being no charge for depreciation. The successful development of this important project, using a new process and a plant designed and operated by the Freeport staff, is a source of great pride to the management.

It is our hope that arrangements can be made whereby this plant can continue to operate as an additional source of nickel for this country and as an important factor in national defense. Final disposition of the plant is under consideration by the interested government departments, but is as yet undetermined.

New Caledonia.—New Caledonia was surpassed by Cuba in 1945 as a producer of nickel. The Sociètè Le Nickel owns a number of properties in various parts of the island, but the most important are those around Thio on the east coast and around Voh and Koné on the west coast. Its smelter, comprising four furnaces, is at Noumea and produces a matte containing 77 to 78 percent nickel. During the war the matte was exported to the United States, where it was refined at Huntington, W. Va. With the end of the war, the matte will as formerly be sent to the company works at Le Havre, France. However, as a result of the proposal to install additional electric power facilities, it is planned to refine the matte in New Caledonia.[8]

The nickel ore produced in New Caledonia contains 2.5 to 5 percent nickel.

Production of nickel ore and matte in New Caledonia, 1941–44, in metric tons

	1941	1942	1943	1944
Ore	395,348	256,555	210,697	231,850
Matte	8,085	6,600	7,025	7,248

Norway.—The Falconbridge nickel refinery at Kristiansand, which, during the period of occupation, had been operated under German control, was found to be intact and in good condition when Norway was liberated, but all stocks of matte were depleted.[9] During the period of occupation, the output of two Norwegian mines and some ore from Petsamo were also used. In July 1945 shipments of matte from Canada to Kristiansand were resumed.

U. S. S. R.—It is reported that the productive facilities at the Petsamo nickel properties are being restored and that operations have begun at the Kaulatunturi mine.[10] Rich nickel deposits in Nivalo, near Petsamo, are to be further investigated with a view to their exploitation.[11] Pure nickel will soon be produced at Monchegovsk in the Kola Peninsula; the mines were closed when the Germans occupied the area.[12] In the Southern Urals the nickel mine and smelter at Norilsk in far Northern Siberia is producing more than five times as much metal as before the war.[13]

[8] Metal Bulletin (London), No. 3013, July 24, 1945, p. 13.
[9] Falconbridge Nickel Mines, Ltd., 17th Annual Report: 1945, p. 10.
[10] Metal Bulletin (London), No. 3043, Nov. 9, 1945, p. 13.
[11] Chemical Age (London), vol. 52, No. 1352, May 26, 1945, p. 469.
[12] Metal Bulletin (London), No. 3016, Aug. 3, 1945, p. 9.
[13] Mining World (London), vol. 7, No. 8, July 1945, p. 20.

United Kingdom.—The following table shows the consumption of primary nickel in the United Kingdom, according to the British Iron and Steel Federation.

Consumption of primary nickel in the United Kingdom, 1942–45, by uses, in long tons

Use	1942	1943	1944	1945
Alloy steels	16, 842	11, 947	8, 186	4, 407
Nickel iron alloys	720	1, 071	893	317
Nickel chromium alloys	409	728	930	680
Malleable nickel	610	741	618	1, 188
Cupro-nickel (wrought products)	1, 872	1, 452	685	523
Nickel silver (wrought products)	110	93	116	319
Nonferrous foundries	76	77	60	73
Nickel aluminum alloys	556	526	380	82
Nickel anodes	549	565	537	776
Miscellaneous uses	7	17	15	23
	21, 751	17, 217	12, 420	8, 388

COBALT

By Hubert W. Davis

SUMMARY OUTLINE

SUMMARY

Cobalt was of great importance in the production of some essential military equipment, and its consumption in high-speed steel, stellite and carbide-type alloys, magnets, jet-propulsion gas turbines, and other applications expanded phenomenally during the war. Despite the large increase in use, however, supplies were adequate for requirements.

During the first half of 1945 domestic consumption of cobalt for industrial purposes was at the record rate of 233 tons monthly as compared with an average of 193 tons monthly in 1944 and 185 tons in 1943. However, had not hostilities with Japan ended on August 14, usage ultimately would have exceeded 600 tons monthly, chiefly because of the requirements of cobalt in the jet-propulsion gas turbine. Vitallium, an alloy containing about 65 percent cobalt, 30 percent chromium, and 5 percent molybdenum, is used for the turbine buckets of both the gas turbines and the turbo-superchargers.[1] To provide for the increased demand the African Metals Corp. (which refines cobalt at Niagara Falls, N. Y.), at the request of the War Production Board early in 1945, made arrangements with the Union Minière du Haut Katanga (which produces cobalt metal and alloy in the Belgian Congo) to supply to the United States monthly 600 tons of cobalt in finished and other forms. To this end it was planned to use the refining capacity (in excess of 200 tons a month) at Niagara Falls, N. Y., the refining plant (capacity about 200 tons a month) at Oolen, near Antwerp, Belgium, and the new refining plant (capacity about 225 tons a month) at Jadotville, Belgian Congo. However, the end of the war in Europe, followed soon thereafter by victory in the Pacific, completely changed the requirements. Meanwhile, the plant at Niagara Falls continued operating, although at a reduced rate during the last quarter of 1945, the plant in Belgium resumed in June, and the new plant in Belgian Congo was brought into production, and as a consequence output of metal substantially exceeded demand during the latter half of 1945, resulting in the accumulation of sizable stocks.

[1] Iron Age, vol. 157, No. 1, Jan. 3, 1946, p. 126.

Production of cobalt ore in the United States established a new record and was 33 percent greater than in 1944. Imports of cobalt in all forms were also greater (18 percent) than in 1944 but 20 percent less than in 1943, the peak year.

Consumption of cobalt contained in ore, alloy, and concentrate by refiners or processors was 12 percent less than in 1944, but consumption of cobalt products by industrial consumers declined only about 4 percent, owing mainly to increased demand for salts, driers, ground-coat frit, pigments, and carbide-type alloys.

Maximum prices for cobalt metal, fines, powder, oxides, and other alloys and compounds established by the Office of Price Administration on November 2, 1943, continued in effect in 1945. The maximum price for metal containing 97 percent cobalt was fixed at $1.50 to $1.57 a pound on contract and $1.60 to $1.67 on spot sales. The maximum prices for other cobalt products were the highest charged by a seller on a delivery made during January, February, or March 1942. Cobalt ores, concentrates, and crudes are exempt from the provisions of the price regulation.

Further developments upon a combined chemical and electrolytic process that will materially facilitate the production of cobalt metal from domestic ores are reported in Bureau of Mines Report of Investigations 3832.[2]

The metallurgical treatment of cobalt ores from the Goodsprings mining district, Nevada, are reported in Bureau of Mines Report of Investigations 3836.[3]

Refining of cobalt ores is the subject of United States Patent 2,379,659.

MINE PRODUCTION AND DEVELOPMENT

Production and shipments of cobalt ore in the United States were 33 and 130 percent, respectively, greater in 1945 than in 1944. The St. Louis Smelting & Refining Co., Fredericktown, Mo., displaced the Bethlehem Steel Co., Bethlehem, Pa., as the chief producer in 1945. The Bureau of Mines is not at liberty to publish figures on production and shipments of cobalt in the United States for 1944 and 1945; however, shipments may now be revealed for 1940 to 1943 and were as follows: 1940, 127,000 pounds; 1941, 521,627 pounds; 1942, 661,657 pounds; and 1943, 763,772 pounds.

The St. Louis Smelting & Refining Co., which began production of cobalt commercially at its property near Fredericktown, Madison County, Mo., in July 1944, produced 79 percent more cobalt in 1945 than in 1944. The complex ore is treated in a flotation mill, which yields a nickel-cobalt concentrate, a lead concentrate, and a copper concentrate containing some lead. The roasted nickel-cobalt concentrate produced in 1945 contained about 19 percent nickel and 13 per-

[2] Shelton, F. K., and others, A Study of Certain Factors in the Hydrometallurgy and Electrodeposition of Cobalt: Bureau of Mines Rept. of Investigations 3832, 1945, 43 pp.

[3] Shelton, F. K., Metallurgical Treatment of Cobalt Ores from the Goodsprings Mining District, Nevada. Bureau of Mines Rept. of Investigations 3836, 1946, 34 pp.

cent cobalt; it was sold to the Office of Metals Reserve. In addition to the roasted concentrate, some ore and calcines were produced and shipped to The Pyrites Co., Wilmington, Del. Production of nickel-cobalt concentrate was suspended in September 1945. The problem of making a successful recovery of separate products of nickel and cobalt is being studied by the St. Louis Smelting & Refining Co. The Bureau of Mines continued its investigation on the extraction of cobalt, nickel, and copper from a pyritic reject accumulated in the milling operation of the company.

The Bethlehem Steel Co. produced 4 percent less cobalt than in 1944. The cobalt is contained in the sulfides that accompany the magnetite mined at Cornwall, Pa. The cobalt-bearing material (averaging 1.4 percent cobalt in 1945) is shipped to The Pyrites Co., Wilmington, Del., where it is processed to metal and other cobalt products.

The Sullivan Mining Co., Kellogg, Idaho, recovered 67 short tons of residues, containing 5,855 pounds of cobalt, at its electrolytic zinc plant. However, it made no shipments in 1945.

The Blackbird mine near Salmon, Idaho, was acquired by the Calera Mining Co., a wholly owned subsidiary of the Howe Sound Co. During 1945 an adit about 500 feet long was driven to crosscut the shear zone in the vicinity of the Chicago claim. Approximately 1,000 feet of drifting and crosscutting has been completed in the zone, and an ore shoot, which offers promise of extensions at both ends, has been developed for a length of about 600 feet. The average width of the ore, which is mostly massive sulfide, is about 20 feet. The ore carries copper and gold as well as cobalt. According to the Howe Sound Co.,[4] "the work to date is most encouraging and during 1946 should be sufficiently advanced to definitely determine the commercial possibilities of the mine."

FOREIGN TRADE [5]

Imports.—Imports of cobalt into the United States in 1945 were 18 percent greater than those in 1944 and the second-largest ever recorded. The Belgian Congo continued to be the chief source of imports into the United States; in 1945 it supplied 1,486 pounds of metal and 8,397,145 pounds of alloy containing 3,616,000 pounds of cobalt. Canada supplied 40,000 pounds of metal, 859,940 pounds of ore containing 109,112 pounds of cobalt, and 120,672 pounds of oxide containing 89,300 pounds of cobalt. Belgium and Germany, respectively, supplied 465,805 and 438,684 pounds of metal. The receipts from Germany represent metal seized by the United States Army; the metal was placed in Government stock piles. The United Kingdom supplied 500 pounds of metal.

[4] Howe Sound Co., Annual Report: 1945, p. 3.
[5] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cobalt imported for consumption in the United States, 1941–45, by classes [1]

Year	Alloy			Ore			Metal	
	Pounds		Value	Pounds		Value	Pounds	Value
	Gross weight	Cobalt content		Gross weight	Cobalt content			
1941 [1]	9,970,589	4,064,276	$4,330,085	2,443,725	262,653	$257,702	554,030	$842,288
1942	[2] 10,313,867	[2] 4,188,687	[2] 3,971,056	834,797	91,597	99,898	148,304	228,452
1943	[3] 10,110,879	[3] 4,357,335	(4)	[5] 10,556,042	[5] 1,268,788	[5] 1,620,869	266,670	373,948
1944	[3] 8,500,516	[3] 3,737,000	(4)	[6] 473,529	[6] 61,123	[6] 53,434	73,088	102,323
1945	[3] 8,397,145	[3] 3,616,000	(4)	859,940	109,112	91,554	946,475	1,582,670

Year	Oxide		Sulfate		Other salts and compounds	
	Pounds	Value	Pounds	Value	Pounds	Value
1941	38,002	$55,120	4,480	$3,779	500	$885
1942					200	448
1943	58,928	95,463			56	164
1944	225,609	400,356			115	354
1945	120,672	215,563			224	700

[1] In addition to classes shown, 4,796,000 pounds of Burmese speiss, containing 335,721 pounds of cobalt, were reported by processor to Bureau of Mines as imported in 1941; value not available.
[2] Includes 2,384,915 pounds of alloy, containing 980,000 pounds of cobalt and valued at $867,799, received in December 1942 but recorded as January 1943 by U. S. Department of Commerce.
[3] Reported by importer to Bureau of Mines; not separately classified by U. S. Department of Commerce.
[4] Data not available.
[5] Recorded by U. S. Department of Commerce as 12,253,292 pounds, containing 1,995,168 pounds of cobalt and valued at $2,270,889; these figures, however, include some alloy.
[6] Recorded by U. S. Department of Commerce as 1,628,066 pounds, containing 522,188 pounds of cobalt and valued at $499,087; these figures, however, include some alloy.

Exports.—Exports of cobalt are small, as is evident from the next table. Cobalt salts and compounds, which were 107 percent greater than in 1944, comprised the bulk of the exports in 1945, and Algeria, Brazil, Mexico, Norway, Sweden, and the U. S. S. R. took 79 percent of the total. Exports of metal and alloys declined from 348,439 pounds in 1944 to 1,856 pounds in 1945.

Cobalt exported from the United States, 1943–45, by classes

Class	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Ore and concentrates	38,755	$58,182	5	$33	50	$95
Metal and alloys	368,989	537,664	348,439	520,763	1,856	3,943
Oxide	14,699	29,105	92,031	183,158	(1)	(1)
Salts and compounds	20,836	17,955	40,046	30,488	83,041	48,835

[1] Not separately classified by the U. S. Department of Commerce.

CONSUMPTION

Refiners or processors.—Consumption of cobalt contained in alloy, ore, and concentrate by refiners or processors was 4,808,825 pounds in 1945 compared with 5,457,000 pounds in 1944. In addition, the cobalt content of other cobalt raw materials consumed by refiners or processors in 1945 was as follows: Fines, 453,538 pounds; hydrate, 133,831 pounds; carbonate, 18,460 pounds; and rondelles, 64,872 pounds. Thus, the total cobalt content of cobalt raw materials consumed by refiners or processors was 5,479,526 pounds in 1945, of which about 86 percent was processed to metal, oxide, and hydrate and 14 percent was used in making salts and driers.

Refiners and processors of cobalt in the United States in 1944, the cobalt product made, and the cobalt raw material used are listed on page 628 of the Cobalt chapter in Minerals Yearbook, 1944.

Specified cobalt products[1] produced and shipped in the United States, 1944–45, in pounds

Product	Produced		Shipped (gross weight)[2]
	Gross weight	Cobalt content	
1944:			
Oxide	364,877	226,350	311,198
Hydrate	416,513	155,043	448,825
Salts and driers	8,633,891	653,288	8,712,038
1945:			
January–September:			
Oxide	371,040	261,560	566,545
Hydrate	260,268	98,197	260,065
Salts and driers	8,063,341	553,243	7,816,203
October–December:			
Oxide	79,461	55,634	75,964
Hydrate	68,504	27,771	79,859
Salts:			
Acetate	59,191	13,800	63,183
Carbonate	15,425	7,549	14,026
Sulfate	33,027	6,716	17,572
Other	3,794	813	2,804
Driers	2,360,099	146,475	2,389,252

[1] In addition, cobalt metal (rondelles, granules, fines, and powder) was produced, but the Bureau of Mines is not at liberty to publish figures on production and shipments.
[2] Comprises shipments to customers, deliveries to Office of Metals Reserve, and consumption at producing plant. Excludes sales of imported products and sales by Office of Metals Reserve.

Industrial consumers.—Consumption of cobalt (exclusive of salts and driers) by industrial consumers was 3,734,255 pounds in 1945, a decrease of 6 percent from 1944; about 92 percent was used for metallic purposes and 8 percent for nonmetallic applications in 1945 compared with 95 and 5 percent, respectively, in 1944. The largest use of cobalt in 1945 was for stellite and stellite-type alloys, but 11 percent less cobalt was thus used than in 1944. The second-largest amount was employed in magnets, which used 16 percent less cobalt than in 1944. Less cobalt also was used in high-speed steel, but substantially more was employed in carbide-type alloys, ground-coat frit, and pigments in 1945 than in 1944. The quantity of salts and driers used is not known; however, the quantity of salts and driers produced in 1945 contained 728,596 pounds of cobalt compared with 653,288 pounds in 1944.

Cobalt consumed in the United States, 1943–45, by uses [1]

[Exclusive of salts and driers]

Use	Pounds of cobalt		
	1943	1944	1945
Metallic:			
High-speed steel	399,736	361,437	335,059
Stellite and stellite-type and carbide-type alloys	2,041,409	1,757,673	1,617,353
Magnets	1,032,374	1,322,097	1,105,880
Welding rod and stock for tipping tools	70,068	89,061	31,293
Dies and valve steel	29,604	36,865	25,566
Other	186,664	233,782	318,967
Total metallic	3,759,855	3,800,915	3,434,118
Nonmetallic:			
Ground-coat frit	80,504	116,884	173,428
Pigments	39,384	53,654	100,789
Other	35,415	17,459	25,920
Total nonmetallic	155,303	187,997	300,137
	3,915,158	3,988,912	3,734,255

[1] Comprises metal, oxide, purchased scrap, and cobalt-nickel compound, and ore used directly in magnets and other industrial applications.

STOCKS

Stocks of cobalt held by refiners or processors, industrial consumers, and Office of Metals Reserve are given in the following table.

Stocks of cobalt held by refiners or processors, industrial consumers, and Office of Metals Reserve on December 31, 1945

Product	Pounds of cobalt		
	Refiners or processors	Industrial consumers	Office of Metals Reserve
Alloy, ore, concentrate, matte, and speiss	1,797,332	13,763	[1] 2,839,025
Metal (rondelles, granules, fines, and powder)	(2)	753,098	421,762
Oxide	11,429	137,350	293,984
Cobalt-nickel compound		77,586	
Hydrate	17,516		
Salts and driers	623,946	(3)	
Scrap:			
Purchased		10,208	
Home		473,567	

[1] Of this quantity, 647,320 pounds are stored at Deloro, Canada.
[2] Bureau of Mines not at liberty to publish figures.
[3] Figures not available.

WORLD PRODUCTION

As cobalt-production data for many countries are lacking, it is impossible to prepare an accurate statement of world output. The following table shows world production by countries, 1938–45, insofar as statistics are available.

World production (partly estimated) of cobalt, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	Cobalt-bearing material	Cobalt content							
		1938	1939	1940	1941	1942	1943	1944	1945
Australia	Cobalt oxide [2]	20	20	18	20	20	15	13	(3)
Belgian Congo	Cobalt alloy	1,532	(3)	[4] 1,423	[4] 1,844	[4] 1,900	[4] 1,976	[4] 1,695	(3)
Bolivia (exports)	Cobalt ore	------	------	2	2	(5)	(5)	(3)	(3)
Burma	Cobaltiferous nickel speiss	[6] 238	[6] 229	218	73	(3)	(3)	(3)	(3)
Canada	Cobalt ores, oxide, and metal	208	332	360	119	38	80	16	49
Chile	Cobalt ore	(3)	(3)	(3)	2	(5)	3	5	(3)
Morocco, French	do	720	730	365	79	3	275	284	(3)
Northern Rhodesia [6]	Cobalt alloy	1,073	1,598	1,223	650	914	943	978	874
United States (shipments)	Cobalt ore	------	------	58	237	300	346	(7)	(7)

[1] In addition to countries listed, Brazil, China, Finland, Germany, Italy, Japan, Mexico, Spain, and Sweden produce cobalt, but production data are not available.
[2] Produced from Australian ore.
[3] Data not available.
[4] Imports into United States.
[5] Less than 1 ton.
[6] Year ended June 30, of year stated.
[7] Bureau of Mines not at liberty to publish figures.

Belgian Congo.—Belgian Congo continues to be the world's chief source of cobalt. To meet the increased demand for cobalt during the war, the Union Minière du Haut Katanga installed at Jadotville two single-phase cobalt electric furnaces to supplement the four previously in existence, thereby bringing the monthly capacity of this plant to about 300 tons. In addition, the company also erected at Jadotville a new refining plant capable of producing about 225 tons a month of refined cobalt granules of high purity and very low carbon content. Thus, the total possible monthly production is about 525 tons. The company resumed operations at the mine and cobalt-concentrating plant at Kabolela and opened and equipped a new cobalt mine and ore-treatment plant at Kamoto. Production data for Belgian Congo have not been published since 1938, when 1,532 metric tons were produced. Since 1938, however, production has increased substantially.

The following information concerning the cobalt activities of the Union Minière du Haut Katanga is contained in a monograph published by that company in 1943.

The refinery has also two rotary furnaces refining crude copper from Lubumbashi and the cobaltiferous red alloy from the electric furnaces. The solutions used in the electrolytic plants contain cobalt. This metal is recovered by a special process of precipitation, the precipitates being smelted in the cobalt electric furnaces. In the near future it will be treated by electrolysis in a new plant by a process developed in the company's research laboratories.

The electric furnace plant comprises six furnaces and smelts the cobalt-bearing ores and slags, as well as the cobaltiferous precipitates coming forward from the electrolytic works. The fines are first sintered in a Dwight-Lloyd machine. The furnaces are of 650 Kw. on single phase current and have an upper diameter of over six feet. The elements added to the charge are lime, as a flux, and nut coke, as a reducer. Nearly all of the cobalt and copper is reduced.

The metal tapped from the furnaces separates into two layers. The lower one is a kind of crude copper containing cobalt, which is treated in the rotary furnaces of the copper refinery. The upper layer is crude cobalt; it is cast into ingots, or granulated by pouring it on a flat jet of cold water. The granules or ingots are sent to the United States, where they are treated to produce pure cobalt or cobalt salts.

Canada.—Production of cobalt (content) in Canada increased to 109,123 pounds in 1945 from 36,283 pounds in 1944. The Silanco Mining & Smelting Corp., which operates a concentrator and mines cobalt-silver ore at the Agaunico and other properties in and about Cobalt, Ontario, was the chief producer in 1945. The mining and beneficiation of cobalt ore by the Silanco Mining & Smelting Corp. have been described by McLaren.[6]

The Silanco Mining & Smelting Corp. has begun construction of a smelter 1 mile south of Gillies siding and 6 miles from Cobalt on the Temiskaming & Northern Ontario Railway.[7] The smelter will have a daily capacity of 10 tons of concentrates, using electric furnaces for smelting and chemical treatment for separation of the copper, nickel, arsenic, and silver in the ores.

The reduced demand for and large stocks of Canadian cobalt are viewed with some alarm by the Northern Miner, which comments as follows:[8]

> Production in the Cobalt district is now down to only one important operation because of difficulties encountered in finding a good market for cobalt. Silanco Mining & Smelting Corp. continues at a reduced scale but is only selling one-half its concentrates and is adding to the greatest stock pile of cobalt metal in Cobalt's history. Silanco has 2,000 tons or more of concentrates and Temiskaming Testing Laboratories is holding something like 500 tons for a number of different small producers. Added to this is a large stock pile of finished and unfinished metal for the United States Government at another point in Canada.
>
> Canada's single cobalt smelter at Deloro has kept its refinery busy throughout the war years treating for the British Government high cobalt content residues secured as a byproduct from the Rhodesian copper producers. * * * The Canadian plant has treated Canadian ores and concentrates whenever stock piles reached a point where operation of the smelter justified. * * *
>
> While at first glance stocks of cobalt in Canada would appear to be a handicap to the return of a satisfactory market, those close to the industry take the view that they will encourage the use of the metal. Inquiries have been received for unusually large tonnages and it is felt that for the first time the producers of the Cobalt area are able to consider a commitment of that kind. * * *

Northern Rhodesia.—The second-largest producer of cobalt in the world is Northern Rhodesia, where the mineral occurs associated with copper in certain of the ore found in the copper mines. The production of cobalt by the Rhokana Corp. has been described by the South African Mining and Engineering Journal.[9]

According to the Rhokana Corp.:[10]

> The smelter practice in connection with cobalt production has not been basically altered during the war years but the steady increase in the iron content of the ore with greater depth in mining has increased production difficulties enormously. Recently, conditions have been such that it was impossible to meet the specifications for alloy to be shipped for refining and it became necessary to re-treat considerable quantities of alloy in the converters. By these means, shipments were maintained but losses and costs were inevitably increased.

6 McLaren, D. C., Milling Cobalt Ore at Silanco: Canadian Mining Jour., vol. 66, No. 3, March 1945, pp. 141–145.

7 Bankhead, H. M., American Embassy, Ottawa, Canada, Feb. 5, 1946.

8 Northern Miner, Cobalt Mining Has Hard Sledding: Vol. 31, No. 27, Sept. 27, 1945, p. 4.

9 South African Mining and Engineering Journal, Production of Cobalt—Process Adopted at Nkana Mine: Vol. 54, part I, No. 2635, July 31, 1943, pp. 465, 467. See also Minerals Yearbook, 1943, pp. 648–649.

10 Rhokana Corp., Ltd., Annual Report: 1945, pp. 1–20.

Work is proceeding on the construction of the cobalt gravity plant which will treat the material in the secondary concentrating circuit to make a higher grade cobalt concentrate.

Production of cobalt by the Rhokana Corp., 1940–45, in short tons

Year ended June 30	Alloy	Cobalt contained	Year ended June 30	Alloy	Cobalt contained
1940	3,291	1,348	1943	2,582	1,040
1941	1,785	717	1944	2,662	1,078
1942	2,484	1,008	1945	2,415	963

U. S. S. R.—The Urals branch of the Academy of Sciences is reported to have carried out successful experiments for obtaining cobalt and nickel from the Elizavetinski iron-ore mine.

United Kingdom.—The United Kingdom depends on imports for its cobalt, and during the war its supplies of metal, oxides, and salts were furnished by the Deloro Smelting & Refining Corp., Cobalt, Ontario, which refined cobalt alloy from Northern Rhodesia.

Cobalt consumed in the United Kingdom, 1942–45

Form	Long tons of cobalt			
	1942	1943	1944	1945
Metal	314	382	471	323
Oxides and salts	125	131	218	244
Alloy	69	113	98	81
	508	626	787	648

MOLYBDENUM

By Edwin K. Jenckes

SUMMARY OUTLINE

SUMMARY

In 1945, for the second successive year, the production of molybdenum concentrates dropped from the all-time high of 1943. The output (in terms of molybdenum content) of 30,802,000 pounds was 80 percent of that for 1944. In contrast, consumption increased 4 percent over 1944. The net result of decreased production and increased consumption, plus an excess of exports over imports, was a decline of 13 percent in the stocks in the hands of producers and consumers of concentrates in 1945.

Imports of molybdenum concentrates in 1945 declined to 19 percent of those for 1944 and included a substantial quantity imported from Canada for conversion and return to that country. Exports in 1945 decreased to 48 percent of those for the previous year. Exports were made to Canada, U. S. S. R., France, Sweden, and the Netherlands.

Salient statistics of the molybdenum industry in the United States, 1941–45, in thousands of pounds of molybdenum contained in ore and concentrates

	1941	1942	1943	1944	1945
Production	40, 363	56, 942	61, 667	38, 679	30, 802
Imports for consumption	4	756	1, 789	3, 499	665
Shipments (including exports)	38, 377	66, 437	53, 955	39, 423	32, 524
Consumption	[1] 16, 891	56, 388	49, 891	31, 520	32, 696
Stocks (producers' and consumers') Dec. 31	21, 226	12, 540	17, 811	[2] 19, 335	16, 899

[1] 6 months, July to December.
[2] Revised figure.

Inasmuch as the principal use of molybdenum is in alloy steels, its consumption follows their production in a general way. Alloy-steel production decreased 19 percent in 1945 compared to 1944, but the drop in consumption of the molybdenum compounds entering into alloy steel was only 14 percent, the difference being accounted for by the broadening of the use of molybdenum as an alloying element. The consumption of other molybdenum products increased 57 percent.

WAR PRODUCTION BOARD AND CIVILIAN PRODUCTION ADMINISTRATION ACTIONS

War Production Board Order M–21–a (allocation of alloy iron and steel) was revoked on May 4, 1945, and was superseded by Order M–21 of May 4, 1945, as amended. This order provided that alloy steel and alloy iron (as defined by the order) should not be melted except upon approval by WPB and that producers of alloying materials (whether ferro-alloys or other compounds usable in iron and steel) should file monthly production schedules with the Board.

Order M–21 (iron and steel), as amended, was reissued on August 24, 1945, and provided that WPB "may issue from time to time" directions regulating the production and distribution of alloy steel and iron and ferro-alloys and alloying compounds.

Order M–21–j (tool steel) was issued April 7, 1945, and amended May 18, 1945. This order directed that, of all high-speed steel melted, delivered, or accepted, not over 15 percent should be class B (straight tungsten steel) and the balance should be class A (to contain 6.75 percent or less of tungsten and 3 percent or more of molybdenum). This order was necessitated by the extremely large tungsten requirements of the armed services for the tungsten carbide projectile cores. This order was revoked July 2, 1945.

Order M–110 (molybdenum), which required suppliers of molybdenum products to report sales of more than 2,000 pounds of molybdenum per month, was revoked May 21, 1945.

Direction 6 to Order M–21 was issued July 20, 1945, continuing the allocation control of molybdenum wire.

Order M–369 (molybdenum) was reissued April 10, 1945, and continued the allocation of molybdenum metal, molybdenum products, and tungsten-molybdenum alloys. Because of the easing of military requirements, Order M–369 (allocation of molybdenum products) was revoked July 20, 1945. This revocation left molybdenum wire the only molybdenum product under control.

Direction 6 to Order M–21 was revoked August 21, 1945, thus removing the last WPB control of molybdenum or its products.

On November 3, 1945, Executive Order 963 abolished the War Production Board and established the Civilian Production Administration, which then assumed the controls previously exercised by WPB.

DOMESTIC PRODUCTION

During the first 8 months of the year, shipments of molybdenum concentrates exceeded production, but in September and subsequent months this condition was reversed. The net result was a decrease in concentrate inventories held by their producers and consumers of 2,436,000 pounds (in terms of Mo content) during the year. However, the year-end stocks of 16,899,000 pounds represent substantially a 6 months' supply at the 1945 average consumption rate.

Domestic shipments from 1914 to 1945, inclusive, are shown in the accompanying table.

The total United States production of molybdenum concentrates for 1914–45, inclusive, has amounted to 424,935,000 pounds of Mo

Molybdenum in ore and concentrates shipped from mines in the United States, 1914–45 [1]

Year	Pounds	Value [2]	Year	Pounds	Value [2]
1914–18	1,601,643	$2,070,213	1940	25,329,000	$17,189,000
1919–23 [3]	355,493	370,371	1941	38,377,000	25,996,000
1924–28	8,498,343	6,160,304	1942	66,437,000	47,275,000
1929–33	18,954,917	11,406,000	1943	53,955,000	38,500,000
1934–38	94,077,000	64,244,000	1944	39,423,000	27,999,000
1939	32,415,000	22,157,000	1945	32,524,000	23,107,000

[1] For shipments by years, 1914–38, see chapter of this series for 1941.
[2] Largely estimated by Bureau of Mines.
[3] No shipments in 1920 and 1921.

contained. There was a small production before 1914, which probably did not exceed 100,000 pounds of Mo.

Total production of molybdenite declined 7,877,800 pounds of contained Mo (20 percent) in 1945 as compared to 1944. Production at straight molybdenum mines dropped 5,239,100 pounds (22 percent), and byproduct molybdenum output by other producers declined 2,638,700 pounds (18 percent). The byproduct molybdenum represented 38 percent of the total molybdenite produced in 1945, as compared to 35 percent in 1944. Molybdenite was recovered at 10 operations during 1945, of which 3 only operated on molybdenum ore. Of the 11 producers in 1944 one, Mammoth-St. Anthony, Ltd., Tiger, Ariz., has reported no production in 1945.

Producers of molybdenum concentrates in the United States in 1945

Type of ore	Molybdenum mineral	Location of mine	Operator
Molybdenum	Molybdenite	Climax, Colo	Climax Molybdenum Co.
Do	do	Urad, Colo	Molybdenum Corp. of America.
Do	do	Questa, N. Mex	Do.
Copper	do	Miami, Ariz	Miami Copper Co.
Do	do	Bagdad, Ariz	Bagdad Copper Corp.
Do	do	Camp Verde, Ariz	Squaw Peak Copper Mining Co.
Do	do	Ruth and Kimberly, Nev.	Kennecott Copper Corp., Nevada Mines Div.[1]
Do	do	Santa Rita, N. Mex	Kennecott Copper Corp., Chino Mines Division.
Do	do	Bingham, Utah	Utah Copper Co.
Tungsten	Molybdenite and powellite.	Pine Creek, Calif	United States Vanadium Corp.

[1] Ore of the Consolidated Coppermines Corp. is milled in same circuit with Kennecott ore.

REVIEW BY STATES

Molybdenite was produced in six States in 1945, the order of magnitude of production being Colorado, Utah, New Mexico, Arizona, Nevada, California. Although molybdenum is known to occur in other States, no deposits of commercial importance have been developed.

Arizona.—Three producers recovered molybdenite as a byproduct of copper mining. Miami Copper Co. has been producing molybdenite since 1938 from copper ores mined at Miami, Ariz. The concentrates are roasted to molybdenum oxide and shipped east to the market. Bagdad Copper Corp. produced concentrates during the first quarter of 1945 but has reported no production since March.

The production of the Squaw Peak Copper Mining Co. was sporadic in the first 4 months of the year, no production having been made in the latter months. Mammoth-St. Anthony, Ltd., reported no production in 1945.

California.—A small quantity of molybdenum concentrates was produced by the United States Vanadium Corp. at Bishop as a by-product of its tungsten operation, substantially 90 percent of it being in January. The mining operations at Bishop have been curtailed severely during the entire year.

Colorado.—Colorado is by far the largest producer of molybdenite in the United States and supplied over half of the output in 1945. Two companies operate in the State; each mines primarily for molybdenite.

Climax Molybdenum Co.[1]—Between 1926 and 1941 the milling capacity of the Climax mill was increased from 1,200 to 18,000 tons a day, largely by plant additions. Under the stress of wartime requirements, changes in milling practice enabled the plant to raise the capacity to a consistent 20,000 tons a day, and refinements in the flotation circuit insured a high percentage of recovery. Recovery at the normal rate is 91 percent, which drops to 88.6 percent under forced conditions. The recovery can be raised to 93 percent if the rate is dropped slightly below normal. It is interesting to note that the ball mills are lined with chrome-molybdenum steel. Mill heads run 0.65 percent MoS_2, 1.0 to 1.5 percent iron sulfide, and 0.01 percent copper. The concentrates shipped under the company label run less than 0.2 percent copper, 0.3 percent iron, and 0.15 percent combined lead and zinc.

In the spring of 1945 the National Mediation Committee settled a dispute between the International Union of Mine, Mill, and Smelter Workers and the company concerning seniority and other grievances. The demand for a closed shop was not granted.[2] In April 1946 the company employed about 600 men, the smallest crew employed since 1932. However, the demand for molybdenum has fallen to such an extent that consumers have not suffered from a shortage of the material. Current milling practice is described by W. H. Dennis in the May 1945 issue of Mine and Quarry Engineering and in the May 1945 issue of The Mining World.

Molybdenum Corp. of America.—The Urad mine at Empire, Colo., owned and operated by the Molybdenum Corp. of America, has been a consistent shipper of concentrates throughout the year, although it has not yet been possible to operate the mine and mill at capacity because of a shortage of labor.

Nevada.—Molybdenite is recovered by the Kennecott Copper Corp. at its McGill copper concentrator from ore mined at the Ruth mine and the Copper Flat open pit. Ore from the Emma Nevada Group of the Consolidated Coppermines Corp. is also milled at the McGill concentrator.

New Mexico.—There are two producers of molybdenite in New Mexico, the Molybdenum Corp. of America at Questa and the Chino Mines Division of the Kennecott Copper Corp. at Hurley. The Questa property, which has been operated since 1919, is operated for

[1] Mining World, Wartime Milling at Climax: Vol. 7, No. 6, May 1945, pp. 15–19.
[2] Arizona Mining Journal, vol. 28, No. 22, April 15, 1945, p. 22.

molybdenum only. At Hurley molybdenite has been recovered as a byproduct of copper operations since 1937.

Utah.—The operations of the Utah Copper Co. at Arthur and Magna, where molybdenite is recovered as a byproduct, make Utah the second largest producer in the United States. There is no other producer of molybdenum in Utah.

EXPLORATION AND DEVELOPMENT

During 1945 the Bureau of Mines examined properties in Okanogan and Skagit Counties, Wash.; Bonner County, Idaho; and Mesa County, Colo. None of these deposits offers commercial possibilities at the present time.

The Geological Survey has studied the occurrence of molybdenum in porphyry copper deposits. Reports on the Castle Dome and Bagdad deposits, Arizona, are being prepared for publication. About 50,000 pounds of MoS_2 a month could be recovered at Castle Dome if facilities were available. Bagdad has produced concentrates. San Manuel copper deposit, Pinal County, Ariz., is under investigation, and preliminary geologic maps have been released for distribution.

Reports of the Survey's investigation on the following deposits have been prepared and are open for inspection.

Mine	District	County	State	Ore reserve (tons)	MoS_2 content (percent)
Loma Prieta	Copper Basin	Yavapai	Arizona	1,750,000	0.10-0.15
Big Ben	Neihart	Cascade	Montana	3,100,000	.20- .33
Starr		Okanogan	Washington	850,000	.20- .30
New Year's Eve	Amargosa Molybdenum and Copper Corp. properties.	Pima	Arizona	65,000	.20- .50
Esperanza	Amargosa Molybdenum and Copper Corp. properties.	Pima	Arizona	(1)	.05
Pine Creek	Bishop	Inyo	California	854,000	1.00

1 Large tonnage.

CONSUMPTION AND USES

Molybdenum is employed predominantly as an alloying element in iron and steel, but molybdenum finds important though relatively small uses in electrical equipment (radio and radar), special heat- and corrosion-resistant alloys, lithographing and printing inks, chemical reagents, and other minor applications. Molybdenum finds its way into the consumers' hands in many forms, as illustrated in the accompanying table.

Consumption of molybdenum products in the United States, July 1941–December 1945, in thousands of pounds of contained molybdenum

Year	Ferromolybdenum	Calcium molybdate	Molybdenum oxide [1]	Other [2]	Purchased scrap	Total
1941 [3]	3,899	2,724	6,546	372	510	14,051
1942	10,673	5,501	27,824	414	1,252	45,664
1943	6,663	5,099	26,383	580	2,940	41,665
1944	4,617	2,351	21,303	631	2,777	31,679
1945	4,560	2,166	17,583	989	1,631	26,929

1 Includes also molybdenum trioxide and molybdic acid, 1942–44.
2 Ammonium molybdate, sodium molybdate, molybdenum silicide, molybdenum metal, and alloys; also molybdenum trioxide and molybdic acid in 1941.
3 July to December.

During the early years of World War II molybdenum, either alone or in combination with other elements, was used as a substitute for scarcer materials, particularly tungsten and nickel. This application of molybdenum reduced visible stocks at the rate of approximately a million pounds a month in late 1941 and early 1942. In 1943 other alloying elements became increasingly available and were therefore employed to replace the molybdenum that had been substituted for them. However, the applicability of molybdenum had been broadened as a consequence of experience gained in these new applications. Before the war [3] molybdenum was used in about 30 percent of the total tonnage of alloyed engineering steels but is now a component of 80 percent of these steels. A part, at least, of this increase has resulted from the relative availability of molybdenum compared to that of other alloying elements. However, its growing field is indicated by numerous reports of new applications. The outstanding example of a new use for molybdenum in alloy steel is its addition to stainless steel to improve corrosion resistance. Practical applications have been made in the United States in the handling of highly corrosive chemicals,[4] and a thorough study of the corrosion resistance of this type of steel has been made in the U. S. S. R.[5] In Germany Cr-Ni-Mo steels are employed to combat corrosive effects encountered in the processing of fats, oils, and their products.[6] The improvement in tensile properties of 12-percent chromium steel by the addition of molybdenum in quantities up to 1 percent is noted in an article by Sanderson,[7] who also reported on an investigation into the graphitization in molybdenum-steel piping used to withstand high pressures and temperatures, which has been fully described by Kerr and Eberle.[8] The influence of molybdenum in Russian low-alloy steel, Russian specification AE 84, which corresponds closely to SAE X 4340, has been reported upon.[9] Other corrosion-resistance applications of molybdenum-containing alloys are in the impellers of gas turbines (16 percent Cr, 25 percent Ni, 6 percent Mo, and 0.08 percent carbon) used in jet-propulsion engines, and in turbine buckets for both gas turbines and turbo-superchargers, which are made of vitallium (65 percent Co, 30 percent Cr, and 5 percent Mo).[10]

It is reported that the engine of the Crosley postwar automobile will be built of thin sheet-steel stampings instead of castings and forgings and that the cylinder walls, which are only 1/16 inch thick, will be of Cr-Mo steel.[11] In spite of the stringent shortage of molybdenum in Germany, its use in tool and special steels was considered necessary, as is shown by the analyses of a large number of these

[3] Dennis, W. H., Molybdenum: Mine and Quarry Eng., vol. 10, No. 5, May 1945, pp. 119-123.
[4] Wheaton, G. S., and Sunderlin, R. S., Materials of Construction in a Metabisulphite Plant: Chem. and Met. Eng., vol. 52, No. 11, November 1945, pp. 231-232.
[5] Chemical Age (London), Recent Russian Work on Corrosion: Vol. 54, No. 1384, Jan. 5, 1946, pp. 5-9.
[6] Chemical Age (London), Chemical Plant in Germany: Vol. 54, No. 1386, Jan. 19, 1946, p. 81.
[7] Sanderson, L., Metallurgical Progress: Mine and Quarry Eng., vol. 10, No. 10, October 1945, pp. 252-254.
[8] Kerr, H. J., and Eberle, F., Graphitization of Low-Carbon and Low-Carbon-Molybdenum Steel: Steel, vol. 116, No. 12, Mar. 19, 1945, pp. 118-120 and 160, 162, and 164.
[9] Doronin, V. M., Influence of Alloying Elements in Cr-Ni-Mo Steel: Iron Age, vol. 154, No. 5, Aug. 3, 1944, pp. 65-67; also the Russian magazine Stal, Nos. 1-2, 1943.
[10] Iron Age, vol. 157, No. 1, Jan. 3, 1946, pp. 125-126.
[11] Washington Sunday Star, New Crosley Bodies To Be of Aluminum: Vol. 2129, No. 37,150, Jan. 20, 1946, p. A-8

steels in a comprehensive article by Gill.[12] The effect of molybdenum in cast iron has been studied and reported upon.[13]

The fabrication of molybdenum wiré at the plant of the Wickwire Spencer Metallurgical Co. has been described in a recent publication.[14] Wartime requirements for elemental molybdenum—largely for radio, radar, and electrical equipment—necessitated very large expansion of facilities for producing the pure metal.[15] The use of molybdenum products which do not enter into the production of iron and steel to an appreciable extent (molybdenum metal, ammonium molybdate, sodium molybdate, and special molybdenum alloys) has increased over 100 percent in the period 1942–45. These special products are used largely in electrical equipment (particularly in radio and radar as pointed out above), in dry color lakes for printing and lithographing inks, and in special alloy applications, such as hard facing compounds, hard cutting alloys, and heat- and corrosion-resistant materials.

STOCKS

Stocks of molybdenite in the hands of producers and consumers of concentrates reached a low point of 8,060,700 pounds of molybdenum in May 1943, in spite of largely increased production. This decline was the result of four factors: Expansion of the tonnage of alloy steels of which molybdenum was an established component; substitution of molybdenum for scarcer alloying elements; development of new applications; and large net exports much for Lend-Lease account.

Stocks of molybdenite for 1942–45 are shown in the accompanying table.

Stocks (Jan. 1 and Dec. 31) of molybdenite in hands of producers and consumers of MoS_2 and consumers of molybdenum products in the United States, 1942–45, and net yearly change in such stocks

Year	Mo contained, thousands of pounds		
	Jan. 1	Dec. 31	Net change during year [1]
1942	21,226	12,540	−8,686
1943	12,540	[3] 17,811	[2] +5,271
1944	[2] 17,993	[3] 19,335	+1,342
1945	19,335	16,899	−2,436
Net change			[4] −4,327

[1] Net change due to balancing of production, receipts, consumption, shipments, and inventory adjustments.
[2] Stock figure for Jan. 1, 1944, includes 182,000 pounds not previously reported in statement of inventories.
[3] Revised figure.
[4] Figure covers stock change noted in footnote 2.

Year-end stocks in the hands of the Office of Metals Reserve have been: 1943—2,167,000 pounds; 1944—3,972,700 pounds; 1945—4,746,200 pounds. All but 2,000 pounds of these stocks are imported concentrates.

[12] Gill, James P., German Toolsteel and Special Steel Industry: Steel, vol. 117, No. 13, Sept. 24, 1945, pp. 120–136.
[13] Kinsella, Joseph C., The Role of Molybdenum and Associated Alloys in Cast Iron: Canadian Metals and Met. Ind., vol. 8, No. 6, June 1945, pp. 36–37.
[14] Such, Irwin H., Tungsten and Molybdenum Wire: Steel, vol. 116, No. 13, Mar. 26, 1945, pp. 90–91, 110.
[15] McClement, M. H., The War Job of Tungsten and Molybdenum Products: Steel, vol. 118, No. 9, Mar. 4, 1946, p. 141.

PRICES

During 1945 the quoted price of molybdenite held at 45 cents per pound of MoS_2 in 90-percent concentrates, the published price since 1938. This is an open-market price, and contracts probably can be obtained at a somewhat lower figure, dependent upon the quantity involved, terms of payment, etc.

The following prices for molybdenum products, which were quoted in the trade journals during the year, conform to maximum prices established by the Office of Price Administration in MPR-489, dated November 8, 1943.

Product:	*Per pound contained Mo*
Ferromolybdenum	$0.95
Molybdenum oxide, technical (powder or briquets)	.80
Calcium molybdate	.80

FOREIGN TRADE[16]

Imports of molybdenite into the United States are normally small but increased greatly during the war years. The peak of importation was in 1944, when 3,499,000 pounds of molybdenum (in concentrates) were brought in. In 1945 this figure fell to 665,000 pounds, an 81-percent decrease.

Exports declined for the third year in succession and amounted to 48 percent of those in the previous year. For many years export sales have constituted a major market for molybdenum and in some years have been estimated to be as high as 60 to 70 percent of sales. It is unquestionably true that there is a large potential market in European countries which the United States has the productive capacity to supply.

The last Lend-Lease shipment of molybdenum was made in July 1945. Lend-Lease shipments are included in the export figures in this report.

Imports and exports of molybdenum ore and concentrates in 1944 and 1945 appear in the accompanying tables.

Molybdenum ore and concentrates imported for consumption in the United States, 1944-45, by countries

Country	1944			1945		
	Pounds		Value	Pounds		Value
	Gross weight	Molybdenum content		Gross weight	Molybdenum content	
Canada	[1] 2,245,520	[1] 1,145,440	[1] $1,086,072	[1] 887,153	[1] 460,416	[1] $443,359
Chile	3,811,772	2,164,888	1,285,127	251,368	138,252	75,000
Mexico	39,178	22,296	15,622			
Peru	323,555	166,518	119,882	124,753	66,131	48,126
Total	6,420,025	3,499,142	2,506,703	1,263,274	664,799	566,485

[1] Imported for conversion and reexport.

[16] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Molybdenum ore and concentrates exported from the United States, 1944–45, by countries

Country	1944			1945		
	Pounds		Value	Pounds		Value
	Gross weight	Molybdenum content		Gross weight	Molybdenum content	
Canada	1,656,087	853,906	$683,305	1,176,800	705,633	$468,400
France	----------	----------	----------	704,104	354,142	231,959
Netherlands	----------	----------	----------	22,400	12,544	10,097
Sweden	----------	----------	----------	191,400	115,364	91,954
U. S. S. R.	7,958,830	4,021,005	2,758,104	3,257,858	1,674,834	1,126,777
United Kingdom	2,239,846	1,110,489	727,398	----------	----------	----------
Total	11,854,763	5,985,400	4,168,807	5,352,562	2,862,517	1,929,187

WORLD PRODUCTION AND DEVELOPMENTS

Reliable data concerning the production of molybdenum are incomplete, but it is a reasonable assumption that the United States continued to be the world's largest producer. The interest in molybdenum as a steel-alloying element in the U. S. S. R. (indicated above in the section on Consumption and Uses), coupled with the continued exports to that country from the United States, may be taken as an indication that the Russian developments noted below have not yet reached a point at which that country is self-sufficient in molybdenum.

World production of molybdenum in ores and concentrates, 1938–45, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Australia [1]	32	39	20	24	7	15	9	(2)
Canada [1]	3	(3)	5	47	43	178	480	220
Chile	-------	30	267	229	580	680	1,058	(2)
Italy	4	4	21	(2)	(2)	(2)	(2)	(2)
Korea (Chosen)	59	(2)	(2)	(2)	(2)	[4] 63	(2)	(2)
Mexico	483	523	310	522	855	1,138	717	468
Morocco, French	94	84	57	29	6	8	(2)	(2)
Norway	462	427	288	233	368	232	248	(2)
Peru	85	165	166	146	154	85	62	[4] 30
Turkey	41	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United States	15,103	13,755	15,564	18,309	25,829	27,972	17,545	13,972
Other countries [5]	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
Total [4]	16,400	15,100	16,800	19,600	27,900	30,500	20,200	15,600

[1] Gross weight of ore and concentrates reported; molybdenum content estimated.
[2] Estimate included in total.
[3] Less than 1 ton.
[4] Estimate.
[5] Estimate by the author for Greece, Rumania, and Yugoslavia included in total; in addition, molybdenum ore is produced in Burma, China, Finland, France, Japan, Manchuria, Sweden, and U. S. S. R., but data of production are not available or are incomplete.

Canada.—The La Corne Molybdenite Project continued to be the principal producer in 1944. A description of the geology of the deposit and the milling practice has been published.[17]

[17] McLaren, D. C., La Corne Molybdenite Project: Canadian Min. Jour., vol. 66, No. 6, June 1945, pp. 371–379.

Chile.—Molybdenum concentrates were produced at the rate of about 150 tons a month at the Braden Copper Co. In 1944, 61 percent of the molybdenum imported into the United States came from Chile.[18] Although molybdenum is known to occur in the ores of the three big copper companies, it is recovered from those of the El Tiente mine of the Braden Copper Co. only. Because of wartime demand, the production was increased from 30 tons of Mo in concentrates in 1939 to 680 tons in 1943.[19] The 1944 production was 1,058 tons.

Finland.—In 1944, 193.9 metric tons of molybdenite concentrates were produced, of which 20 to 30 tons were retained for domestic consumption and the balance exported.

Germany.—The substitution of alloying elements in the engineering steels in Germany during the war followed a definite pattern—as nickel became scarce, Cr-Mo and Cr-Mo-V steels replaced nickel steels; next, when the supply of molybdenum ran low, Cr-V and Mo-V steels were adopted; and, finally, when Cr became extremely critical, recourse was had to Mn-V and Mn-Si steels. However, molybdenum was considered necessary in special applications, such as high-speed steel and special steels for resistance to extreme corrosion.

Greece.[20]—During the war the Krupp Co. invested large sums in a flotation plant and other equipment to concentrate molybdenum south of Gevgeli in the Department of Florena. This machinery is intact, but the property is idle. The deposits are said to contain about 1 percent MoS_2. Other deposits are known, but no effective prospecting has been done.

Japan.[21]—Molybdenum deposits are known in Japan, and production came from the Yamasa mine in Shimane Prefecture and the Hirase mine (the largest producer), Gifu Prefecture. Japan imported small quantities of molybdenum from Korea (Chosen).

Korea (Chosen).—The Korean production of molybdenite is small, being probably less than 200 metric tons a year.[21] The principal producers were the Chosui mine (North Zenra Province) and the Seiyo mine (South Chusei).

Mexico.—The Department of National Economy reports production of 780 metric tons and exports of 773 tons of molybdenite in 1945. The Cananea Consolidated Copper Co. at Cananea, Sonora, is the principal producer. The production in and exports of molybdenite from Mexico, 1939–44, in metric tons have been as follows:[22]

	1939	1940	1941	1942	1943	1944
Production, ore and concentrates	871	516	870	1,426	1,897	1,195
Mo content (estimated)	523	310	522	855	1,138	717
Exports, ore and concentrates	924	532	923	1,421	1,885	1,188

[18] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, p. 3.

[19] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, p. 38.

[20] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 2, Feb. 20, 1946, p. 17.

[21] Bureau of Mines, Foreign Minerals Survey, Mineral Resources of Japan: Vol. 2, No. 5, October 1945, p. 43.

[22] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, pp. 82 and 84.

In 1943 the concentrates were sent to the United States for transshipment to the United Kingdom and U. S. S. R.[23]

Norway.—Norway's output of molybdenite in 1939 was 722 metric tons compared with 379 tons in 1943. The A/S Knaben Molybdängruber plant[24] was seriously damaged by bombs twice during 1943. In that year the operation produced 353 metric tons of MoS_2 in concentrates. There was no production from Kvina Gruver, but Oterstrand Gruber (formerly Laksadalen Molybdengruber A/S) produced about 28 metric tons of 82 percent concentrates. During the first 9 months of 1944, 285.8 metric tons of concentrates were produced compared to 308.5 tons in the corresponding period of 1943.

Peru.—The 1944 production figures of the Peru Molibdeno, S. A., the only company mining molybdenum in Peru, have been revised slightly from the figures reported in the 1944 chapter of this series. This latest report states that 22,704 metric tons of ore averaging 0.462 percent MoS_2 were produced, from which 104.6 metric tons of concentrates running 82.73 percent MoS_2 were obtained. The concentrates which were exported to the United States contained "a small amount of copper." From 1936 to 1945, 1,899 metric tons of concentrates containing 1,533 tons of MoS_2 were produced. The prewar market for this company was in England, Germany, or Japan. Measured or known reserves in November 1944 were estimated at 12,000 metric tons containing 0.6 percent MoS_2. The ore is concentrated by flotation. The only other producer,[25] the Salazar mine of Toribia Atachaguay Salazar, is very small. Peru's 1945 production is expected to decline abruptly.

Production in and exports of molybdenum in concentrates from Peru, in metric tons, have been as follows:[26]

	1939	1940	1941	1942	1943	1944
Production	165	166	146	154	85	62
Exports	115	176	147	194	99	53

Spain.—The production of wulfenite in Spain amounted to 27 metric tons in 1945 compared to 18 tons in 1944 and 25 tons in 1943. The La Reconquista mine at Velez de Benaudalla, Granada, has a capacity of 2 tons a month. In 1942, 11 tons of ore containing 9 percent Mo were refined to a crude molybdic oxide, and an experimental production of calcium molybdate was made.[27] Other prospects at Huejar-Sierra (Granada) and Oria (Almeria) have been examined. Wulfenite is the molybdenum mineral at these properties.

Sweden.—Late quantitative data from Sweden are lacking, but some ferromolybdenum is known to have been produced.[28] In 1935

[23] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, p. 80.

[24] Mining Journal (London), Norway's Mining and Metal Industries in 1943: Vol. 225, No. 5742, Sept. 8, 1945, pp. 583–584.

[25] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, p. 94.

[26] Bureau of Mines, Foreign Minerals Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, pp. 96 and 98.

[27] Bureau of Mines, Foreign Minerals Survey, Mineral Resources of Spain: Vol. 2, No. 1, May 1945, p. 23.

[28] Donogh, R. P., and Stough, D. B., Making Swedish Pig Iron: Foreign Commerce Weekly, vol. 19, No. 7, May 12, 1945, pp. 10–13, and 47–50.

total production was 415 metric tons, of which 359 tons were for export, and in 1939 the quantities were 312 and 166 tons, respectively. Domestic sources of molybdenum were being exploited.

United Kingdom.—Upon the withdrawal of molybdenum from distribution under Lend-Lease, its use in high-speed steel decreased. Tungsten for this purpose was reported to be plentiful.[29]

U. S. S. R.—Reliable production statistics from the U. S. S. R. continue to be lacking, but press notices evidence development of molybdenum resources. In Armenia a molybdenum plant was under construction[30] in the latter part of 1944 and early 1945. Uzbekistan is reported[31] to be an important eastern supplier of molybdenum for wartime use. Near Balkhash Lake the eastern Kounrad molybdenum mine has been opened and a mill erected.[32] This region supplies 60 percent of Russia's molybdenum.[33] Exploration and development work have been increased. The known deposits of molybdenum in Kazakhstan have been increased 25 percent since 1940.[34] Deposits of molybdenum have been discovered recently in the Chianytski area.[35]

[29] Metal Bulletin (London), No. 2965, Jan. 30, 1945, p. 15.
[30] Pravda, Dec. 1, 1944, as cited in Consular Report 1324, Moscow, Dec. 21, 1944 (unrestricted).
[31] Moscow News, Dec. 2, 1944, as cited in Consular Report 1324, Moscow, Dec. 21, 1944.
[32] Kazakhstanskaya Pravda, Alma-ata, Aug. 15, 1944, as cited in Consular Report 1070, Moscow, Oct. 9, 1944 (unrestricted).
[33] Canadian Mining and Metallurgical Bulletin, No. 406, February 1946, p. 91.
[34] Undasynov, N., The Metals of Kazakhstan: Min. Jour. (London), vol. 225, No. 5753, Nov. 24, 1945, p. 802.
[35] Foreign Commerce Weekly, vol. 22, No. 10, Mar. 9, 1946, pp. 31–32.

VANADIUM

By Edwin K. Jenckes

SUMMARY OUTLINE

SUMMARY

The production of domestic vanadium ores in 1945 dropped to 2,963,913 pounds (measured in vanadium content), a decline from the previous year of 563,141 pounds. Consumption of domestic ore amounted to 3,821,419 pounds of contained vanadium and was 291,890 pounds below that in 1944. In both production and consumption 1945 was the second year of progressive decline from the all-time highs established in 1943.

Inasmuch as consumption of domestic vanadium ore exceeded production, stocks of ore at mills decreased during 1945. Inventories on December 31, 1945, represented less than 4 months' supply of ore at the 1945 rate of consumption. However, the relatively high rate of ore consumption has been accompanied by the building up of stocks of vanadium products.

Imports and exports in 1945 increased over those for 1944 by 253,826 pounds and 107,673 pounds, respectively.

Salient statistics of the vanadium industry in the United States, 1941–45, in pounds of vanadium contained

	Pounds of vanadium contained				
	1941	1942	1943	1944	1945
Mine shipments of ores and concentrates [1]	2,513,051	4,439,130	5,586,492	3,527,054	2,963,913
Imports:					
Ore or concentrates	2,138,608	2,422,376	2,052,620	1,284,603	1,552,307
Vanadium-bearing flue dust	(2)	154,028	64,393	40,171	26,293
Exports of ore, concentrates, and vanadium oxide	25,462	22,140	38,180	6,254	113,927
Consumption (domestic ores only)	2,393,478	3,914,673	5,179,290	4,113,309	3,821,419

[1] Measured by receipts at mills and Government purchasing depots.
[2] Data not available.

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GOVERNMENT ACTIONS

War Production Board and Civilian Production Administration.—War Production Board General Preference Order M–23–a (vanadium) was revoked on June 5, 1945, and the authority to regulate the production, distribution, and use of this element then resided in General Preference Order M–21 of May 4, 1945 (as amended)—iron and steel production. This order provided that alloy steel and alloy iron (as defined by the order) should not be melted except upon approval by WPB, and that producers of alloying materials (whether ferro-alloys or other compounds usable in iron and steel) should file monthly production records with the Board. Order M–21 (as amended) was reissued on August 24, 1945, and provided that the Board might issue from time to time directions regulating the production and distribution of alloy steel and iron and ferro-alloys and alloying compounds.

No close formal control over vanadium or its products was exercised during 1945. However, controls could have been re-established under General Preference Order M–21.

On November 3, 1945, Executive Order 963 abolished the War Production Board and established the Civilian Production Administration, which then assumed the controls previously exercised by the Board.

Office of Price Administration.—No changes in or amendments to Maximum Price Regulation 489, which would affect vanadium or vanadium products, were made in 1945. Maximum prices as established by this order are given in Minerals Yearbook, 1944 (p. 643).

Department of Justice.—The United States Department of Justice initiated a Federal grand jury investigation in Colorado of the vanadium-mining industry to determine whether evidence exists to warrant a suit on the grounds of monopolistic practices. This is the first action of its kind to be instituted in the Federal courts of Colorado.

Office of Metals Reserve.—The Office of Metals Reserve succeeded the Metals Reserve Company on July 1, 1945, and all reference to this agency in this chapter will be under the name of Office of Metals Reserve.

DOMESTIC PRODUCTION

The production of domestic vanadium ores for the last 10 years is given in the accompanying table.

Vanadium in ores and concentrates produced in the United States, 1936–45

Year	Pounds of vanadium	Year	Pounds of vanadium
1936	139,512	1941 [1]	2,513,051
1937	1,086,125	1942 [1]	4,439,130
1938	1,613,155	1943 [1]	5,586,492
1939	1,984,068	1944 [1]	3,527,054
1940 [1]	2,162,916	1945 [1]	2,963,913

[1] Receipts at mills and Government purchasing depots.

The production of the United States for the period 1910–45, inclusive, has reached the total of 43,143,000 pounds of contained V, of which 21,192,556 pounds (49 percent) were mined in 1940–45.

The Office of Metals Reserve purchasing program was terminated on February 29, 1944, as the result of the accumulation of large inventories of vanadium in ores and in vanadium products, especially fused vanadium oxide and ferrovanadium. Prices paid for ore had been dictated by the wartime necessity for large quantities of vanadium and many otherwise marginal and submarginal claims became productive during the emergency period. A consequence of the withdrawal of Metals Reserve purchases at high prices was a marked decrease in the number of operators in 1944. In 1945, 75 independent operators delivered ore to the processing mills, compared to 82 in 1944. The quantity of ore so delivered declined, but the ore was of better grade.

Domestic ores may be divided into those occurring in the sediments of the Morrison,[1] Entrada,[1] and Shinarump formations (in which carnotite and roscoelite are the types most frequently mentioned) and various complex ores. The sandstones are found in Colorado, Utah, New Mexico, and Arizona and form the largest source of domestic vanadium. The complex ores include the phosphate rock in Idaho (currently the only commercial source of domestic vanadium not derived from the sandstones), phosphatic shales of Utah, Idaho, and Wyoming, lead vanadates of Arizona and Nevada, and some titaniferous magnetites, particularly those adjacent to Sanford Lake, New York.

Except for the examination of a number of claims, neither the Bureau of Mines nor the Geological Survey did any extended exploring or developing in 1945, but the Survey has published maps covering two vanadium mining areas in the Colorado-Utah fields.[2] [3]

The weighted average of prices as reported to the Bureau of Mines places the value of the 1945 production at $1,766,500.

REVIEW BY STATES

The accompanying table shows the total production by all producers, by States, measured in terms of receipts at mills.

Vanadium in ores and concentrates produced in the United States, 1944–45, by States, in pounds

State	Pounds of vanadium contained	
	1944	1945
Colorado	3,058,727	2,701,103
Utah	287,045	97,572
Other [1]	181,282	165,238
	3,527,054	2,963,913

[1] 1944: Arizona, Idaho, and New Mexico; 1945: Arizona and Idaho.

[1] The name McElmo was formerly and is still locally applied to parts of the Morrison and Entrada formation.

[2] Fischer, R. P., Simplified Geologic Map of the Vanadium Region of Southwestern Colorado and Southeastern Utah: Geol. Survey Pubs., June 1944.

[3] Stokes, W. L., Russell, R. T., Fischer, R. P., and Butler, A. P., Jr., Geologic Map of the Gateway Area, Mesa County, Colo., and the Adjoining Part of Grand County, Utah: Geol. Survey Pubs., May 1945.

Arizona.—One small delivery of ore was made from Arizona. Mammoth-St. Anthony, Ltd. (Tiger, Ariz.), Arizona's oldest vanadium producer, did not recover any vanadium from its complex ores in 1945.

Colorado.—Colorado was the largest producer of vanadium ores, thus maintaining the position it has held since 1942; the Bureau has not been at liberty to publish production figures for all States for the years prior to 1942. At the Uravan plant of the United States Vanadium Corporation, both the main plant and the auxiliary leaching plant for the recovery of vanadium were closed during the entire year, and at the Durango plant both the main plant and the auxiliary leaching plant were idle in the last quarter of the year.[4] [5] The Durango plant was purchased from Office of Metals Reserve by the United States Vanadium Corp.[6] A substantial proportion of the 1945 operation of this plant was the refining of ore on a toll basis for Office of Metals Reserve, the remainder being for company account. The company's plant at Rifle operated throughout the year, but at a reduced rate during the latter months, and mining activity was reduced to development work.[7] A decision of the Nonferrous Metals Commission directing the United States Vanadium Corp. to continue portal-to-portal payments to the miners at Rifle was affirmed by the War Labor Board.[8]

The Grand Junction treatment plant, which had been erected as part of the tailings recovery program, was being dismantled at the end of the year.[9] The properties and plants of the North Continent Mines, Inc., at Slick Rock, Colo., were purchased by the United States Vanadium Corp. in 1945. The mill was not operated during the year.

The Nonferrous Metals Commission denied 2 weeks' vacation with pay after 2 years' employment for Vanadium Corp. of America employees at Naturita. The employees now get 1 week after 1 year and 2 weeks after 4 years. The Commission ordered muckers' pay increased from 75 to 82 cents an hour and that of miners from 83 to 90 cents, plus night differentials. The Vanadium Corp. of America operated its mill at Naturita through September, when the plant was shut down for the remaining months of the year.

The mining operations of the Garfield Vanadium Corp. in Garfield County were resumed after repairing damages caused by a fire that destroyed their shop and some equipment and damaged the compressor.[10]

The discovery of a rich supply of vanadium ore has been announced.[11] This strike, which was named the Hermosa-Barlow Creek Lode, originates near Rico and extends northward beneath Barlow Creek and the Dolores River and on to the watershed of the San Miguel River 5 miles west of Telluride. Later accounts have served to moderate considerably the original optimism over this discovery.

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[4] Mining World, vol. 7, No. 12, November 1945, p. 52.
[5] Arizona Mining Journal, vol. 29, No. 14, Dec. 15, 1945, p. 25.
[6] Mining World, vol. 7, No. 9, August 1945, p. 38.
[7] Arizona Mining Journal, vol. 29, No. 15, Dec. 30, 1945, p. 23.
[8] Engineering and Mining Journal, vol. 146, No. 4, April 1945, p. 136.
[9] Work cited in footnote 4.
[10] Mining Journal, vol. 29, No. 21, Mar. 30, 1946, p. 26.
[11] Mining Record, Colorado Makes Bonanza Strike of Vanadium Ore: Vol. 57, No. 12, Mar. 21, 1946, p. 8.

Idaho, Montana, and Wyoming.—The byproduct recovery of vanadium by the Anaconda Copper Mining Co. from phosphate rock mined at Conda, Idaho, and treated at Anaconda, Mont., has been consistent since 1941. The Phosphoria formation in Idaho and Wyoming contains extensive vanadium-bearing shales, but their treatment offers serious technical difficulties.[12]

Utah.—The Vanadium Corp. of America leased the Monticello plant from the Defense Plant Corporation. The stock pile of ore at Monticello was purchased from the Office of Metals Reserve and is being refined in the Monticello plant.[13] Late in 1945, the Vanadium Corp. of America reached an agreement with the Mercur Dome Gold Mining Co. of Salt Lake City under the terms of which the Corporation will develop the vanadium ore occurring on the Mercur Dome property.[14]

The vanadium-bearing shales in the Camp Floyd mining district in Tooele County [15] have been examined by engineers of the Bureau of Mines.

Although the greater part of the vanadium oxide produced in the United States comes from the sandstone area of Colorado, Utah, and New Mexico, additional recoveries are made from imported ores and concentrates from Peru, which are treated at Bridgeville, Pa.; from phosphate rock; and from flue dust and fly ash from oil-burning ships, largely from those burning Venezuelan fuel oil. Byproduct vanadium is recovered at Glens Falls, N. Y.

CONSUMPTION AND USES

Consumption of domestic vanadium rose continuously from 1940 (the first year for which these data were collected) to the peak year of 1943, when the consumption was 2.4 times that in 1940. Since 1943 consumption has fallen off each year, and that for 1945 was 74 percent of the 1943 figure.

The first step in the processing of domestic vanadium to a marketable form is the conversion of the V in the ore to vanadium pentoxide (V_2O_5). Some vanadium reaches the market in this form for use either as a direct addition to the steel bath or as a catalyzer. In peacetime the proportion of vanadium sold as pentoxide is small, but during the war significant quantities were used in the production of high-octane aviation gasoline.

The preponderant proportion of vanadium pentoxide is converted to ferrovanadium, small quantities going into other vanadium alloys for specialized uses. It is probable that well over 95 percent of the vanadium consumed in the United States finds its way into alloy steel in the form of ferrovanadium.

Vanadium imparts to steel the qualities of increased strength and hardness and enhances the utility of steel at elevated temperatures. The ultimate tensile strength, impact strength, elastic limit, yield point, and resistance to fatigue are raised by proper additions of vanadium to steel. Vanadium steels are inherently fine-grained at

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[12] Johnson, A. C., and Davis, C. W., War Development Proves Large Vanadium Reserves: Eng. and Min. Jour., vol. 146, No. 4, April 1945, pp. 105–107.
[13] Work cited in footnote 8, p. 140.
[14] Mining World, Vanadium Corp. Leases Mercur Dome: Vol. 8, No. 1, January 1946, p. 30.
[15] Work cited in footnote 12.

normal and elevated temperatures and therefore stable under extreme use conditions. The usual vanadium content of the engineering steels is less than 0.2 percent and frequently in the range of 0.05 to 0.10 percent. Vanadium is also a potent agent in producing a clean steel and is a powerful deoxidizing agent, although it is too costly to be used for this purpose except in conjunction with cheaper deoxidizers.

In addition to its wide use in the usual engineering steels, it is an essential component of high-speed tool steel, where it is used to the extent of 1 to 2 percent, the vanadium content depending on the type of steel and the use to which it is to be put.

During the shortages of 1941–43 more abundant alloying elements were substituted for vanadium wherever practicable. Among the extreme examples were the omission of vanadium from rolled tank armor and the use of Mn-Ti steel for high-strength plate for the Navy[16] in place of a vanadium-containing steel. As vanadium became more freely available, it has undoubtedly been finding its way back into steels that did not contain this element during the war. A considerable volume of work has been done in the United States on nitriding vanadium steels.

A new and interesting use for vanadium is in Vicalloy.[17] The preferred analyses are 38.5 percent Fe, 52 percent Co, and 9.5 percent V (Vicalloy I), and 35 percent Fe, 52 percent Co, and 13 percent V (Vicalloy II). After a small amount of hot work, the alloys may be machined, punched, tapped, or drilled. Heat treatment is necessary to develop the preferred magnetic properties.

It is interesting to note that during the war German metallurgists developed a high-speed steel of the following composition: C, 0.90–1.00 percent; W, 2.50 percent; Cr, 4.00 percent; V, 2.50 percent; and Mo, 2.50 percent, which is claimed to be as effective as the conventional 18W–4Cr–1V. It is also noteworthy that in many steels the Germans increased the vanadium content as the war progressed and as other alloying elements became more and more scarce. The same pattern was followed in the cemented-carbide industry in Germany, where a composition known as V814, 45 percent titanium carbide and 45 percent vanadium carbide with 10 percent of binder (either all Ni or 7 percent Ni and 3 percent Co), was developed as a substitute for tungsten carbide containing tool tips. The Germans also developed a number of high-temperature alloys, particularly for use in connection with jet propulsion and gas turbines, among which the four steels in the accompanying table are typical of those containing vanadium.

Analyses of four German high temperature-resistant steels

	C	Si	Mn	Ni	Cr	Mo	V	Ti	W	N_2
V2AED 50 / Vanidur [1]	0.12			10.50	17.50		1.00	0.60		
Cromadur	.15		18.00		12.00		.70			0.18
FKDM 10	.22	0.40	.38		2.8	0.40	.80		0.38	
FKM 10	.22	.40	.38		2.7	.25	.60			

[1] This steel is known as Vanidur after being given 20 percent reduction of area (cross section) by cold rolling. Its properties at high temperatures depend upon this cold work.

[16] Metal Progress, High-Strength Plate for the Navy: Vol. 48, No. 4, October 1945, p. 750.
[17] Nesbitt, E. A., Vicalloy—A Workable Alloy for Permanent Magnets: Am. Inst. Min. and Met. Eng., Tech. Pub. 1973, Metals Technol., vol. 13, No. 2, February 1946, 11 pp.

STOCKS

No data on stocks are available except those pertaining to Office of Metals Reserve holdings.

Office of Metals Reserve.—The refining of the remainder of Office of Metals Reserve vanadium ore at Durango and the sale of the inventory at Monticello have consumed the residue of all of the sandstone ore purchased by that agency. Office of Metals Reserve agents reported on the purchase and disposition of the ore to the Office of Metals Reserve in Washington on one hand and to the Bureau on the other, but not necessarily on the same basis. It is of interest to note how closely the accounting set up by the Bureau of Mines agrees with that by Office of Metals Reserve. The accompanying table presents a "V_2O_5 balance sheet" for the Metals Reserve operations based upon reports made to the Bureau.

Stocks (Jan. 1 and Dec. 31) of Office of Metals Reserve ore, 1942–45, and net yearly changes in such stocks, in pounds of V_2O_5 contained

Year	January 1	December 31	Net yearly change [1]
1942		919,968	+919,968
1943	919,968	2,365,538	+1,445,570
1944	2,365,538	2,019,053	−346,485
1945	2,019,053		[2] −1,770,646
			[3] −236,643
			[4] −11,764

[1] Net change due to balancing receipts and consumption unless otherwise noted.
[2] Consumption and sales.
[3] Over-all inventory adjustment figure from Office of Metals Reserve.
[4] Lack of balance between Office of Metals Reserve and Bureau of Mines accounting.

The item of 11,764 pounds of V_2O_5, difference between Bureau of Mines and Office of Metals Reserve figures, represents less than 0.2 percent of the amount of V_2O_5 involved in 4 years' operation and shows a very satisfactory agreement, taking into account the fact that cross-checking was not resorted to until all the ore was consumed.

PRICES

Vanadium ore has been quoted at 27½ cents per pound of V_2O_5 since 1935. This, however, is a quotation without regard to grade of ore or presence or absence of objectionable impurities, matters of importance to the refiners inasmuch as they affect recovery vitally. It is probable, however, that with the ready availability of vanadium in 1945 the high prices realized during the war were not readily obtainable. The Office of Price Administration has not placed vanadium ore under price control at any time.

Maximum prices established by MPR 489 for vanadium products are given in the 1944 Minerals Yearbook, p. 643, and remained unchanged during 1945.

Prices for vanadium products quoted in trade publications for 1945 were: Ferrovanadium, \$2.75–\$2.90 per pound of V contained (depending on the carbon content of the alloy); and fused vanadium pentoxide, \$1.10 per pound of V_2O_5 contained (for contract deliveries).

FOREIGN TRADE [18]

Vanadium imports into the United States comprise ore, concentrates, dried precipitated vanadium pentoxide, and flue dust. In 1945, all ore, concentrates, and pentoxide were imported from Peru and the flue dust from Curaçao. The percentage of V_2O_5 in the imports from Peru was considerably lower than in 1944.

Vanadium ore or concentrates and vanadium-bearing flue dust imported for consumption in the United States, 1944–45, by countries

Country	1944			1945		
	Pounds		Value	Pounds		Value
	Gross weight	Vanadium content		Gross weight	Vanadium content	
Ore or concentrates:						
Peru	4,247,490	1,284,603	$633,719	8,777,018	1,552,307	$725,666
Vanadium-bearing flue dust:						
Curaçao (N. W. I.)	169,274	36,370	24,695	133,795	26,293	19,378
Venezuela	22,627	3,801	3,364			
	191,901	40,171	28,059	133,795	26,293	19,378

Vanadium ore or concentrates imported for consumption in the United States, 1936–45

Year	Pounds		Value	Year	Pounds		Value
	Gross weight	Vanadium content			Gross weight	Vanadium content	
1936	3,734,080	342,720	$155,730	1941	24,645,686	2,138,608	$1,012,991
1937	14,806,400	1,258,880	638,799	1942	36,492,268	2,422,376	1,274,483
1938	19,962,880	1,384,320	891,475	1943	22,117,131	2,052,620	1,080,150
1939	31,387,722	2,132,548	991,511	1944	4,247,490	1,284,603	633,719
1940	45,102,004	2,574,951	1,216,705	1945	8,777,018	1,552,307	725,666

Exports of vanadium ore and concentrates increased from 6,254 pounds of contained V in 1944 to 113,927 pounds in 1945. The large increase was due to shipments to France. Exports for the years 1943–45 are shown in the accompanying table.

Vanadium ore and concentrates [1] exported from the United States, 1943–45, by countries, in pounds

Country	1943		1944		1945	
	Gross weight	Vanadium content	Gross weight	Vanadium content	Gross weight	Vanadium content
Australia	5,160	1,445				
Canada	75,438	26,186	6,390	2,201	3,049	955
Curaçao (N. W. I.)					13,268	3,715
France					218,500	105,931
India and Dependencies			9,878	4,053	8	2
Iran	37,676	10,549				
U. S. S. R.					6,767	3,324
	118,274	38,180	16,268	6,254	241,592	113,927

[1] Classed as ore and concentrates but probably also includes fused vanadium oxide.

[18] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

WORLD PRODUCTION AND DEVELOPMENTS

Complete information on world production of vanadium in 1945 is lacking, but the indications are that it will be virtually equal to that for 1944. Of the countries for which reliable figures are available, the United States, Peru, and South-West Africa are the largest producers.

World production of vanadium in ores and concentrates, 1938–45, in metric tons

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	-------	15	1	6	-------	-------	(1)	(1)
Mexico	101	80	32	(2)	-------	-------	-------	-------
Northern Rhodesia	374	384	368	342	3 417	3 483	3 148	3 4 210
Peru	826	996	1,214	1,017	1,015	855	516	620
South-West Africa	557	514	428	269	453	577	385	420
United States (shipments)	732	900	981	1,140	2,014	2,534	1,600	1,344
Total 5	2,590	2,890	3,020	2,800	4 3,900	4 4,500	4 2,700	4 2,600

1 Data not available.
2 Less than 1 ton.
3 Exports.
4 Preliminary.
5 Total comprises figures appearing in the table. It is known that Germany produced vanadium from the minette ores; accurate figures are not yet available.

Germany.—The pattern of alloy use in Germany was very definite—when Ni became scarce, Cr–Mo and Cr–Mo–V steels were substituted; as the scarcity of Mo increased, Cr–V and Mo–V steels were adopted; and, finally, with the increasing scarcity of chrome, recourse was had to Mn–V and Mn–Si steels.

Vanadium was the one alloying element found in Germany in quantity sufficient or nearly sufficient for war needs. Reliable data regarding the production of vanadium in Germany are lacking, but the quantity produced must have been large, as evidenced by the widespread substitution of vanadium for other steel-alloying elements. Three sources of vanadium were available to the Germans: (1) the importation of vanadium-bearing slags from Norway; (2) recovery of the element found in the red mud of the Bayer (aluminum) process; and (3) recovery from the minette (iron) ores. The latter source is probably by far the most important of the three. Vanadium occurs in the "minette" ores of Luxembourg and Belgium to the extent of about 0.1 percent V. In the usual German practice this vanadium goes into the pig iron, and, when the iron is blown in a Thomas converter, is concentrated in the slag. Upon remelting the slag in a special blast furnace, the vanadium goes into pig iron, which is again blown in a converter, thus transferring the vanadium into a second slag, which averages 10 percent V.[19] The slag is treated chemically. From 50 to 60 percent of the vanadium in the minette ores is recovered. Comprehensive discussions of German metallurgical practice are available.[20] [21]

19 Joint Intelligence Objectives Agency, Recovery of Vanadium from Iron and Steel Plant Slags: Rept. 23, June 30, 1945.
20 Gill, James P., German Toolsteel and Special Steel Industry: Metal Prog., vol. 49, No. 1, January 1946, pp. 122–124; and Steel, vol. 117, No. 13, Sept. 24, 1945, pp. 120–136.
21 Fry, John H., General Review of German Metallurgical Practices: Metal Prog., vol. 49, No. 1, January 1946, pp. 76–86.

India.—Work has been carried out in the laboratories of the Tata Iron & Steel Co. on the production of a "vanadium bearing intermediate manganese cast steel." [22] The National Vanadium Trust Co. of India has made a laboratory recovery of vanadium pentoxide from deposits in British India, just outside Mayurbhanj State, and from deposits in Mayurbhanj State. A pilot plant is being erected. These ore deposits, which contain iron and titanium as well as vanadium, were discovered 7 or 8 years ago.

New Zealand.—Beach sands, often referred to as "Taranaki iron sands," which contain iron, titanium, and vanadium, occur on the beaches of the North Island from Wanganui to Kaipara Heads and on the west coast of the South Island. No process has been developed for the commercial utilization of these sands, but Brian Mason has described the deposits and suggested [23] that new blast-furnace practice capable of utilizing high-Ti ores may be applicable.

Peru.—The old leaching plant of the Vanadium Corp. of America at Jumasha continued regular operations during the first half of 1945. The new plant, which was erected for the Defense Plant Corporation at a cost of about $4,000,000 and which required 2½ years for completion, was placed in partial operation in October 1944.[24] Full operation was not attained until the end of June 1945.

The decline in Peruvian production from 1940 until 1945 is attributed largely to the gradual exhaustion of direct shipping ore.[25] Exports from Peru during the first 9 months of 1945 were 2,015 metric tons of ore and 1,253 tons of concentrates. Stocks at Callao on September 30 were 172 tons of concentrates.[26] Peruvian production for the year was 1,366,480 pounds of V (620 metric tons of V).

South-West Africa.—South-West Africa has been an important producer and exporter of vanadium concentrates for at least 10 years.

Spain.—Spain has four steel plants capable of producing alloy steel, although the technique and probably the mechanical installations could be improved. Ferrochrome and ferrotungsten have been produced in Spain, but the other alloys are imported. Five metric tons of ferrovanadium are known to have been imported in 1943. About 13,000 metric tons of alloy steel were consumed in 1944.

Sweden.—The development of Sweden's hydroelectric resources has furnished a source of cheap electric energy necessary to the manufacture of ferro-alloys. Late production data are lacking, but in 1935 Sweden produced 24 metric tons of ferrovanadium, all of which was exported, and in 1939, 98 tons were produced, of which 40 tons were exported.[27] It is not known whether this alloy was made from domestic or imported ores.

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[22] Chemical Age (London), vol. 56, No. 1388, Feb. 2, 1946, p. 148.

[23] New Zealand Journal of Science and Technology (March 1945 issue), as quoted in Chemical Age (London), vol. 52, No. 1353, June 2, 1945, p. 487.

[24] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 2, Feb. 20, 1946, p. 24.

[25] Bureau of Mines, Foreign Mineral Survey, Minerals Review of Latin America, 1939–44: Vol. 2, No. 4, October 1945, p. 94.

[26] Work cited in footnote 24.

[27] Donogh, R. P., and Stough, D. B., Making Swedish Pig Iron: Foreign Commerce Weekly, vol. 19, No. 7, May 12, 1945, pp. 10–13, 47–50.

U. S. S. R.—A large deposit of vanadium has been discovered at Jabagai in the steppes of Kazakhstan,[28] [29] and deposits of many of the alloying and base metals have been found in the Ural Mountains. A ferro-alloy plant has been built at Aktiubinsk, and the first sections of iron and steel mills have been opened at Karaganda.

Union of South Africa.—The Bushveld iron ores contain up to 1.5 percent V_2O_5 and 8 to 25 percent TiO_2. Some of the TiO_2 is present as granular ilmenite, which can be separated magnetically, but the vanadium is not present in a mineral that can be separated from the ore by any known physical process. A very large reserve of vanadium will be available if a satisfactory means of separation can be developed.[30]

[28] Undasynov, N., The Metals of Kazakhstan: Min. Jour. (London), vol. 225, No. 5753, Nov. 24, 1945, p. 802.

[29] Akimov, M., Natural Wealth of the Soviet Urals: Min. Jour. (London), vol. 226, No. 5772, Apr. 6, 1946, pp. 265–266.

[30] Schwellnus, C. M., and Willemse, J., Titanium and Vanadium in the Magnetic Iron Ores of the Bushveld Complex: Trans. Geol. Soc. South Africa, vol. 46, 1944, pp. 1–12, quoted in Mine and Quarry Engineering (London), vol. 11, No. 2, February 1946, p. 36.

TUNGSTEN

By Hubert W. Davis

SUMMARY OUTLINE

SUMMARY

The decline in tungsten production that began in May 1944 continued almost uninterruptedly through April 1945. Production was at a low monthly rate of about 340 tons (60 percent WO_3) during the first 4 months of 1945. In May, however, the chemical-treatment plant of the Office of Metals Reserve at Salt Lake City and the mill of Boulder Tungsten Mills, Inc., at Boulder, Colo., resumed operations and the new mill serving the Riley mine, near Winnemucca, Nev., made its initial output. In July the chemical-treatment plant of United States Vanadium Corp. near Bishop, Calif., also resumed operations. Chiefly for these reasons, the monthly rate of production increased to an average of 600 tons during the 5 months May–September. As a consequence of lessened demand for tungsten following VJ-day, output dropped to an average of about 480 tons during the last 3 months of 1945.

Total production of tungsten concentrates was 5,666 short tons (60 percent WO_3 basis) in 1945 compared with 10,260 tons (revised figure) in 1944. The importance of large mining and millings units in the tungsten industry is shown by the fact that four operators, each producing over 500 tons, supplied 68 percent of the entire output in 1945. Domestic production was equivalent to only 38 percent of United States consumption in 1945.

The total quantity of tungsten concentrates shipped from domestic mines from 1900 through 1945 was 110,949 short tons (60 percent WO_3). It is noteworthy that, of the total shipments, 53,449 tons (48 percent) were shipped during the past 7 years (1939–45).

During 1945 the Yellow Pine mine in Idaho of Bradley Mining Co., the M. G. L. mine in Nevada of M. G. L. Mining Co., the Conger mine in Colorado of Vanadium Corp. of America, and the mines in Nevada of Tungsten Metals Corp. were permanently closed because of exhaustion of known ore bodies or for other reasons. The importance of these properties as producers of tungsten is evidenced by the fact that in 1944 their combined output of both primary and secondary concentrates was 275,154 units, equivalent to 4,586 tons of 60 percent WO_3.

Receipts of imported tungsten ore and concentrates were 9,078 short tons (60 percent WO_3 basis) in 1945, a decline of 53 percent from 1944. Supplying 46 percent of the total, Bolivia was the chief source of imports in 1945; and Brazil (26 percent) was the second-largest source.

Consumption of tungsten concentrates was 14,900 short tons (60 percent WO_3 basis) in 1945, a decline of 26 percent from 1944. During the first 8 months of 1945 concentrates were consumed at a rate of 1,538 tons monthly, compared with a rate of 1,675 tons monthly in 1944. As a result of the lessened demand following the end of hostilities with Japan, consumption dropped to an average of 640 tons monthly during the last 4 months of 1945.

Consumption of tungsten powder during the first 8 months of 1945 was at a high rate, chiefly because of the military tungsten carbide shell-core program. In fact, during several months both production and consumption of tungsten powder were greater than ferrotungsten.

Stocks of primary concentrates held by the Office of Metals Reserve were 21,648 short tons (60 percent WO_3 basis) on December 31, 1945. These stocks, when declared surplus, will be transferred to the Treasury Procurement Division, in accordance with the Surplus Property Act of 1944, Public No. 457, Seventy-eighth Congress, section 22 (a), approved October 3, 1944.

Salient statistics of tungsten ore and concentrates in the United States, 1941–45, in pounds of tungsten

Year	Production [1]	Shipments from mines [1]	General imports (receipts)	Consumption	Stocks at end of year: Consumers and brokers	Producers [1]	Government stock pile [1]	Total
1941	6,420,303	6,249,945	13,152,716	16,699,000	2,404,876	263,626	8,117,000	10,785,502
1942	8,977,575	8,882,403	15,409,814	17,389,000	3,416,438	355,864	9,532,000	13,304,302
1943	11,472,985	11,368,295	18,678,426	19,313,000	2,459,246	458,586	21,058,000	23,975,832
1944	[2] 9,764,647	[2] 9,786,537	18,238,890	19,165,000	1,510,419	435,634	27,893,000	29,839,053
1945	5,392,446	5,439,080	8,639,374	14,146,000	3,784,429	389,412	[3] 20,603,000	[3] 24,776,841

[1] Primary concentrates. [2] Revised figures.
[3] Excludes stocks held by the Treasury Procurement Division and United States Navy.

Despite the large stocks of tungsten that had been accumulated, it appeared early in 1945 that they would be insufficient for the requirements of the tungsten carbide shell-core program, which would involve the expenditure of several million dollars in plant and equipment expansion and would greatly expand the consumption of tungsten. Accordingly, the War Production Board, on May 18, 1945, issued Order M–21–j, which limited purchases of tool steel with high tungsten content, and the Office of Metals Reserve resumed operations at its chemical-treatment plant at Salt Lake City, Utah, in May. However, before this program got well under way the European phase of the war was brought to a victorious end, and cut-backs in Army requirements resulted in a cancelation of the plant-expansion program. Inasmuch as tungsten supplies were again ample for all requirements, the War Production Board revoked Order M–21–j on July 3.

Figure 1 shows trends in domestic shipments, imports, and prices of tungsten ore and concentrates since 1915.

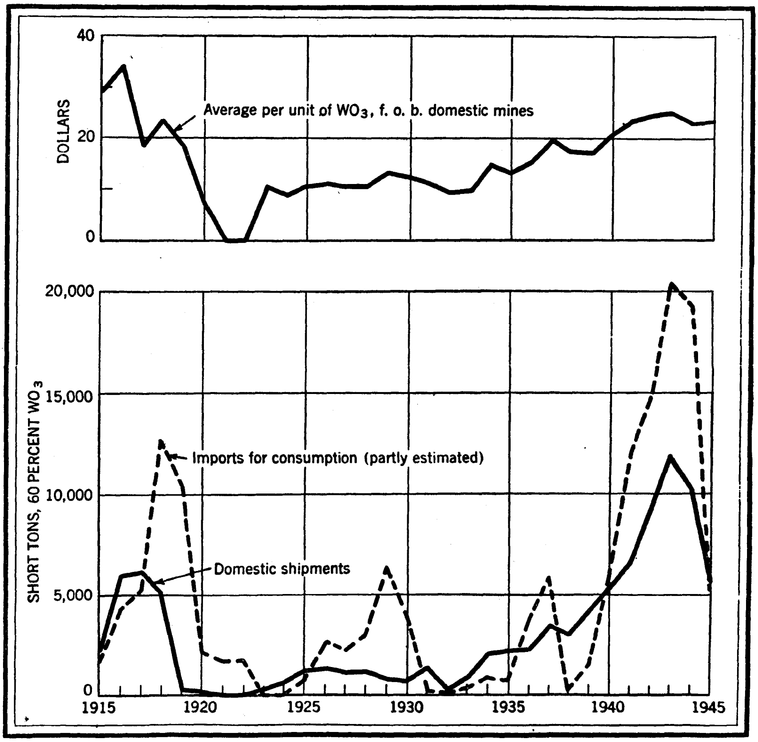

FIGURE 1.—Trends in domestic shipments, imports, and average price of tungsten ore and concentrates, 1915–45.

PRICES

Quotations on tungsten ore and concentrates remained steady throughout 1945. According to the Engineering and Mining Journal, foreign ore was quoted at $24 a short-ton unit of WO_3, duty paid, and domestic scheelite of good known analysis, in carlots, delivered, was $24 to $24.50 a unit. The average price for domestic primary concentrates shipped in 1945, as reported to the Bureau of Mines, was $23.21 a short-ton unit of WO_3.

DOMESTIC PRODUCTION

The tungsten ore mined and milled in the United States, in general, contains 0.5 to 2.5 percent WO_3 and is beneficiated to a concentrate containing 60 percent or more WO_3. Scheelite (calcium tungstate) is the tungsten mineral in most domestic ore mined. The leading tungsten producers and many small operators depend on ore carrying tungsten only as scheelite. Ferberite (iron tungstate), hübnerite (manganese tungstate), and wolframite (iron-manganese tungstate), in the order listed, contribute a comparatively small part of the tungsten in domestic ores. Most of the concentrates are converted to ferrotungsten and tungsten metal. Some high-purity concentrates, however, are charged directly to the steel bath. Wolframite is preferred for the filament in electric light bulbs.

Lessened demand for tungsten in 1945 resulted in a decline in production of primary concentrates to 5,666 short tons (60 percent WO_3 basis), as compared with 10,260 tons (revised figure) in 1944. Output was obtained from many widely scattered operations in 10 States, but 3 States—California, Idaho, and Nevada—supplied 91 percent of the total, and 4 operators (United States Vanadium Corp., Bradley Mining Co., Nevada-Massachusetts Co., and Office of Metals Reserve) produced 68 percent of the United States total.

Since 1942 a substantial tonnage of milling ore and secondary concentrates has been produced; the milling ore was stocked at various purchasing depots of the Office of Metals Reserve, and the secondary concentrates were shipped to the chemical-treatment plants at Salt Lake City, Utah, and Bishop, Calif. The milling ore and secondary concentrates so produced have not been included in the statistics. Since April 1943, however, substantial tonnages of milling ore and secondary concentrates have been treated, and the resulting primary concentrates recovered each year have been credited in the statistics to the State of origin.

Alaska.—No tungsten concentrates were produced in Alaska in 1945. Because of economic conditions and insufficient labor, no milling of tungsten ore was undertaken at the Riverside mine near Hyder; but some development was done and 1,300 tons of ore were produced.

Arizona.—Production of primary tungsten concentrates in Arizona was 140 short tons averaging 41.77 percent WO_3 in 1945 compared with 27 tons averaging 53.3 percent WO_3 in 1944. Shipments were also 140 tons averaging 41.77 percent WO_3 compared with 32 tons averaging 54.31 percent WO_3 in 1944. Williams & Ryan, operating a mill at Tucson, accounted for the bulk of the concentrates produced in 1945; the concentrates produced resulted from treating ore purchased from

Tungsten ore and concentrates produced and shipped in the United States, 1944–45, by States [1]

State	Produced				Shipped from mines			
	1944		1945		1944		1945	
	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units	Short tons, 60 percent WO_3	Units
Alaska	19	1,111			19	1,111		
Arizona	24	1,439	97	5,848	29	1,738	97	5,848
California	2,978	178,705	1,049	62,951	3,027	181,647	1,073	64,380
Colorado	299	17,955	252	15,136	296	17,749	234	14,022
Idaho	3,957	237,434	2,029	121,702	4,005	240,287	2,130	127,787
Missouri	1	62			1	62		
Montana	16	981	26	1,568	25	1,529	(2)	4
Nevada	2,747	164,796	2,065	123,902	2,665	159,924	2,038	122,249
New Mexico	9	496			9	496		
North Carolina	187	11,198	139	8,314	186	11,154	132	7,914
South Dakota	[3] 8	[3] 496	3	189	[3] 7	[3] 421	4	226
Utah	9	564	5	319	9	564	5	319
Washington	6	363	1	69	5	307	2	125
	[3] 10,260	[3] 615,600	5,666	339,998	[3] 10,283	[3] 616,989	5,715	342,874

[1] Excludes secondary concentrates produced as feed for chemical-treatment plants at Salt Lake City, Utah, and Bishop, Calif. Instead, the primary concentrates produced therefrom, as well as shipped, are included.
[2] 147 pounds.
[3] Revised figures.

Tungsten ore and concentrates shipped from mines in the United States, 1941–45

Year	Quantity		Reported value f. o. b. mines		
	Ore and concentrates, 60 percent WO_3 (short tons)	Tungsten content (pounds)	Total	Average per unit of WO_3	Average per pound of tungsten
1941	6,567	6,249,945	$9,223,726	$23.41	$1.48
1942	9,333	8,882,403	13,508,266	24.12	1.52
1943	11,945	11,368,295	17,973,685	25.08	1.58
1944	[1] 10,283	[1] 9,786,537	[1] 14,407,143	[1] 23.35	1.47
1945	5,715	5,439,080	7,957,731	23.21	1.46

[1] Revised figures.

the Office of Metals Reserve. A. A. Cohen, Roy Williams, Gold Hill Dredging Corp., G. W. Campbell, and Dalton Robinett also contributed to the 1945 output.

California.—California dropped from second to third place as a tungsten-producing State in 1945. Output of primary concentrates in 1945 was 1,140 short tons averaging 55 percent WO_3 compared with 2,912 tons averaging 61 percent in 1944. Of the 1945 total, Inyo County supplied 25.8 percent; San Bernardino 22.5 percent; Tulare 24.6 percent; Madera 5.8 percent; and Fresno, Kern, and Mono together 4.1 percent; the source of 17.2 percent was not reported, but the bulk came from Inyo and Tulare Counties.

Shipments of tungsten concentrates from California in 1945 totaled 1,186 short tons averaging 54.28 percent WO_3 compared with 2,940 tons averaging 61.78 percent WO_3 in 1944. The 1945 production and shipment figures include 146 tons of concentrates averaging 68.5 percent WO_3 that were recovered at the Salt Lake City, Utah, chemical plant from the treatment of secondary concentrates originating in California. Although primary tungsten concentrates were shipped from many widely scattered operations, six producers—United States Vanadium Corp. and Tungstar Corp. (in Inyo County), Hoefling Bros. (in San Bernardino County), Tulare County Tungsten Mines and Consolidated Tungsten (in Tulare County), and Haggerty & Madden (in Madera County)—supplied 968 tons or 82 percent of the State total. The bulk of the remainder was shipped from the Salt Lake City plant, the Marble mine in Inyo County, and the Garnet Dike mine in Fresno County.

In addition to the primary concentrates produced and shipped in 1945, 262 short tons of secondary concentrates averaging 7.4 percent WO_3 were shipped to the chemical-treatment plant near Bishop for further treatment; they came from the mine of the Tungstar Corp. The secondary concentrates are not included in the 1945 statistics; instead, the resultant primary concentrates recovered are included.

The United States Vanadium Corp. did not produce any ore at its Pine Creek mine near Bishop, Inyo County, in 1945. Its chemical plant, however, was operated part of January and from late July through December; as a consequence, production of concentrates was only half that in 1944. The plant feed comprised secondary concentrates, chiefly from the Tucson Ore Milling Co. in Arizona, the Yellow Pine mine in Idaho, the Tungstar mine in California, and the Cherry Creek mine and the Mill City mill in Nevada. The primary concentrates recovered from the treatment of secondary concentrates originating in Arizona, Idaho, and Nevada have been credited in the statistics to those States. A rotary nodulizing unit for scheelite concentrate was added to the Pine Creek treatment plant. To eliminate a difficult snow condition that has hampered operations at the Pine Creek mine, a 6,500-foot adit is being driven about 1,500 feet below the original mine entry. The adit terminates directly beneath the present mine workings, and a shaft will connect it with the main operation. Ore will be sent through the adit, which terminates about halfway between the present mine site and the treatment plant.

The Tungstar mine near Bishop, operated by the Tungstar Corp., produced 57 and 54 percent, respectively, less primary and secondary concentrates than in 1944.

On August 1 Hoefling Bros., which works the Spud Patch placer in San Bernardino County, began operating a portable washing plant, which has expanded the scope of the operations into the western part of the area. Nevertheless, production of concentrates was 19 percent less than in 1944.

The Big Jim mine in Tulare County was operated by the Tulare County Tungsten Mines at a greatly increased rate in 1945 and produced 57 percent more concentrates than in 1944.

Haggerty & Madden operated the Strawberry mine in Madera County only about 4 months in 1945, and production of concentrates was 42 percent less than in 1944.

Consolidated Tungsten, operating the Harrel Hill mine in Tulare County, produced 51 percent less concentrates than in 1944.

The El Diablo Mining Co. completed an aerial tramway at the Brownstone mine in Inyo County. The mine was nonproductive in 1945.

The Hi Peak mine and mill of the United States Flare Corp. in Kern County ceased operations on December 25.

The Alpine Mining Co. did considerable development at the Alpine mine in Alpine County and at the close of 1945 was installing a mill to treat the ore.

A new mill to serve the Black Eagle mine in Imperial County was being installed at the close of 1945 by Charles Kirton to replace one destroyed by a cloudburst.

A mill was installed at the Victory mine in Fresno County by Harold Keown.

Colorado.—Production and shipments of primary concentrates (60 percent WO_3 basis) in Colorado were 252 and 234 short tons, respectively, in 1945, compared with 299 and 296 tons, respectively, in 1944.

The Firth-Sterling Steel Co. (Wolf Tongue Division), Geo. H. Teal & Associates, Vanadium Corp. of America, Boulder Tungsten Mills, Inc., and Elmer Hetzer accounted for virtually the entire output.

The Vanadium Corp. of America discontinued operations at the Conger mine in May 1945.

The Boulder Tungsten Mills, Inc., purchased the stock piles of ore at Nederland and Tungsten, Colo., from the Office of Metals Reserve and resumed operations at its mill in May.

The mill of Geo. H. Teal & Associates operated on ores from the Salida, Colo., and Deadwood, S. Dak., stock piles, which were purchased from the Office of Metals Reserve. The concentrates recovered from milling the ore from South Dakota have been credited in the statistics to that State.

The Firth-Sterling Steel Co. (Wolf Tongue Division) began driving a prospect tunnel under Hurricane Hill during 1945.

Idaho.—Production of primary concentrates in Idaho was 1,727 short tons averaging 70 percent WO_3 in 1945 compared with 4,224 tons averaging 56.21 percent WO_3 in 1944. Shipments also declined to 1,852 tons averaging 69 percent WO_3 in 1945 compared with 4,278 tons averaging 56.17 percent WO_3 in 1944. The 1945 production and shipment figures include 768 tons of concentrates averaging 68.5 percent WO_3 recovered at the Salt Lake City, Utah, plant from treating secondary concentrates originating at the Yellow Pine mine of Bradley Mining Co. The figures also include the concentrates recovered from treating Yellow Pine secondary concentrates at the plant of the United States Vanadium Corp. near Bishop, Calif.

The Yellow Pine mine near Stibnite, Valley County, operated by the Bradley Mining Co., was worked at a greatly reduced rate. It produced 109,796 tons of scheelite ore averaging 0.424 percent WO_3 in 1945 compared with 211,382 tons averaging 1.42 percent WO_3 in 1944. The ore mined in 1945, with 45,359 tons of tailings averaging 0.755 percent WO_3 and 3,290 tons of low-grade concentrates averaging 6.322 percent WO_3, was treated, yielding 176 tons of primary concentrates averaging 58.97 percent WO_3 and 5,551 tons of secondary concentrates averaging 9.97 percent WO_3. These secondary concentrates, which were shipped to the plant of the United States Vanadium Corp. near Bishop, Calif., and to the purification plant of the Bradley Mining Co. at Boise for further treatment, are not included in the 1945 statistics; instead, the resultant primary concentrates recovered are included.

All known tungsten ore in the Yellow Pine mine was virtually exhausted in 1945. The presence of tungsten at the Yellow Pine mine was discovered jointly by engineers of the Bureau of Mines and geologists of the Geological Survey in the spring of 1941. Production was initiated in August 1941; between that time and December 31, 1945, 611,284 short tons of ore averaging 1.645 percent WO_3 were produced and treated, from which were recovered 10,373 tons of primary concentrates containing 503,915 units of WO_3 and 29,889 tons of secondary concentrates containing 322,055 units of WO_3. This mine produced more tungsten than any other mine in the United States from August 1941 to December 1945.

Production of primary concentrates at the Ima mine in the Blue Wing district, Lemhi County, was 183 short tons (64.74 percent WO_3) in 1945 compared with 189 tons (68.24 percent WO_3) in 1944. In addition, 16 tons of secondary concentrates (23 percent WO_3) were produced in 1945. The Bradley Mining Co. acquired the Ima mine on January 10, 1945.

Nevada.—Production and shipments of primary concentrates (reduced to an equivalent of 60 percent WO_3) were 2,065 and 2,038 short tons, respectively, in 1945 compared with 2,747 and 2,665 tons, respectively, in 1944. The 1945 production and shipment figures include 421 tons of concentrates averaging 68.5 percent WO_3, which were recovered at the Salt Lake City, Utah, plant from treating Nevada secondary concentrates. In addition, the concentrates recovered in

California from treating Nevada secondary concentrates have been credited to Nevada in the statistics.

The Nevada-Massachusetts Co. and affiliated companies, operating plants at Mill City, Golconda, and Toulon, continued to be the chief producers in Nevada, but output was 33 percent less in 1945 than in 1944. Operations at the Golconda plant were suspended in June 1945. The scheelite-manganese deposit at Golconda has been described by Huttl.[1]

Smaller but important producers of primary concentrates in 1945 were Nevada Scheelite, Inc., operating a mine of the same name in Mineral County, and the Northern Nevada Mining Co., operating the Riley mine in Humboldt County. Nevada Scheelite, Inc., did much development at its mine and added two slime tables and a grinding unit to its mill. The new concentrating mill serving the Riley mine was brought into production on May 25, and both the mine and mill were sold to the United States Vanadium Corp. on October 5. The new owners of the Riley property have installed a flotation mill.

The remaining production of primary concentrates in Nevada in 1945 came from a number of smaller operations. The bulk was, however, produced by the Tungstonia Mining Co., operating the Tungstonia mine, Tungsten Metals Corp., operating the Scheelite Chief, Oriole, Everitt, and Silver Bell mines, and the Cherry Creek Tungsten Co., operating the Cherry Creek mine, all in White Pine County; Lincoln Mines, Inc., and Atolia Mining Co., operating the Lincoln mine in Lincoln County; and the M. G. L. Mining Corp., operating the M. G. L. mine in Pershing County. The mines of the Tungsten Metals Corp. were closed on May 31 and all mine and mill equipment was removed. Lincoln Mines, Inc., was taken over by the Atolia Mining Co. on June 1, and production was suspended on September 1; the mill was improved during the latter part of 1945. Mining and milling operations at the M. G. L. mine ceased on January 10 because of the exhaustion of known ore; all buildings, machinery, and equipment were sold.

In addition to the primary tungsten concentrates produced and shipped in 1945, 1,839 tons of secondary concentrates averaging 13.57 percent WO_3 were shipped to the chemical plants near Bishop, Calif., and Salt Lake City, Utah, for further treatment. These secondary concentrates came from Getchell Mine, Inc., Nevada-Massachusetts Co., United States Vanadium Corp., and Cherry Creek Tungsten Mining Co. These secondary concentrates have been omitted from the 1945 statistics, but the resultant primary concentrates recovered are included.

The flotation plant of Getchell Mine, Inc., which discontinued milling tungsten ore on June 20, 1944, resumed operations in August 1945, treating (under toll agreement with the Office of Metals Reserve) the stock piles of ore in the vicinity of the mill. During the remainder of 1945, 45,773 tons of ore were milled which yielded 1,470 tons of concentrates averaging 15.6 percent WO_3. The concentrates were shipped to the chemical plant at Salt Lake City for further treatment.

North Carolina.—Effective June 11, 1945, Tungsten Mining Corp.,

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[1] Huttl, J. B., Unique Golconda Deposit Yields Its Tungsten: Eng. and Min. Jour., vol. 146, No. 8, August 1945, pp. 79–81.

wholly owned by Haile Mines, Inc., and General Electric Co., took over the operation of the Hamme tungsten mine in Vance County. Production of concentrates was 219 short tons averaging 37.89 percent WO_3 in 1945 compared with 321 tons averaging about 35 percent in 1944.

The Southern Aggregates Corp. did no mining at its property, also in Vance County. However, extensive core drilling was carried on; as a result additional ore bodies were located and known ore bodies proved at greater depth.

South Dakota.—A small stock pile of ore (172 tons averaging 2.03 percent WO_3) at Deadwood was purchased from the Office of Metals Reserve by the David Taylor Co. in 1945. The ore was treated in the George Teal mill at Boulder, Colo. The O-F Exploration Co. shipped a small quantity of tungsten concentrates from stock; they were produced at a property near Keystone, Pennington County, in 1944.

Utah.—Production and shipments of high-grade tungsten concentrates in 1945 were each 5 short tons averaging 64 percent WO_3 compared with 10 tons averaging 56 percent in 1944.

The chemical-treatment plant of the Office of Metals Reserve at Salt Lake City resumed operations in May 1945 after being inactive since April 30, 1944. During 1945 it treated 8,658 tons of concentrates averaging 11.9 percent WO_3. The plant feed comprised secondary concentrates, chiefly from the Yellow Pine mine of Bradley Mining Co. and the mill of Getchell Mine, Inc. The resultant primary concentrates produced and shipped in 1945 have been credited in the statistics to California, Idaho, and Nevada.

Washington.—A small quantity of concentrates (69 units of WO_3) was produced at the Germania Consolidated mine in Stevens County in 1945. Output in 1944, which came from the Deer Lake, Keith, and Germania Consolidated mines, was 5 tons averaging 68 percent WO_3.

The tungsten occurrences in Washington have been described by Culver and Broughton.[2]

FOREIGN TRADE[3]

Domestic production is inadequate for requirements, and the United States imports both tungsten concentrates and products, chiefly the former. Receipts of imported ore and concentrates totaled 8,639,374 pounds (tungsten content), equivalent to 9,078 short tons of 60 percent WO_3 in 1945, a decrease of 53 percent from 1944. Although ore and concentrates were received from 18 foreign countries in 1945, two—Bolivia (46 percent) and Brazil (26 percent)—supplied 72 percent of the total.

Imports for consumption amounted to 4,773,861 pounds (tungsten content), equivalent to 5,016 short tons of 60 percent WO_3 in 1945; Bolivia, Brazil, and Argentina supplied 51, 28, and 16 percent, respectively, of the total. In addition, 331,510 pounds (tungsten content), equivalent to 348 tons of 60 percent WO_3, were imported from Bolivia and Peru (duty free) for smelting, refining, and export.

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[2] Culver, H. E., and Broughton, W. A., Tungsten Resources of Washington: Washington Dept. of Conservation and Development, Div. of Geology, Bull. 34, Olympia, Wash., 1945, 89 pp.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

The duty on tungsten ore or concentrates is 50 cents a pound on the metallic tungsten contained therein. This is equivalent to \$7.93 a short-ton unit.[4]

Exports of tungsten ore and concentrates from the United States are insignificant; 4,240 pounds were exported in 1945 compared with none in 1944.

There were no imports of tungstic acid in 1945 compared with 21 pounds (tungsten content) in 1944. Imports of tungsten metal were 4,396 pounds in 1945 compared with none in 1944. No tungsten carbide or combinations containing tungsten or tungsten carbide were imported in 1944 and 1945.

Exports of tungsten metal, stellite, wire, shapes, and alloys other than ferrotungsten were 260,435 pounds in 1945 compared with 313,174 pounds in 1944. Exports of ferrotungsten were 861,461 pounds in

Tungsten ore and concentrates imported into the United States, 1944–45, by countries

Country	General imports [1]		Imports for consumption [2]		
	Gross weight (pounds)	Tungsten content (pounds)	Gross weight (pounds)	Tungsten content (pounds)	Value
1944					
Argentina	4, 321, 724	2, 266, 856	4, 321, 724	2, 266, 856	\$3, 171, 621
Belgian Congo			45, 565	25, 543	26, 849
Bolivia	17, 329, 014	7, 841, 821	17, 345, 420	7, 850, 382	10, 920, 028
Brazil	4, 387, 310	2, 141, 350	4, 214, 038	2, 045, 499	2, 662, 045
Burma			157, 568	78, 890	77, 780
Canada	996, 960	226, 815	899, 040	170, 900	172, 783
Chile	4, 264	2, 900	4, 264	2, 900	2, 300
China	6, 214, 458	3, 534, 964	6, 388, 559	3, 626, 221	5, 193, 870
India and Dependencies	162, 660	90, 720	162, 660	90, 720	136, 800
Mexico	733, 499	383, 245	785, 809	409, 789	465, 950
Peru	3, 760, 208	1, 750, 219	3, 768, 898	1, 755, 043	1, 959, 392
Portugal			82, 092	42, 291	36, 980
Union of South Africa			60, 785	31, 243	32, 224
	37, 910, 097	18, 238, 890	38, 236, 422	18, 396, 277	24, 858, 622
1945					
Argentina	1, 606, 326	851, 968	1, 439, 885	764, 391	901, 159
Australia	49, 177	21, 333			
Belgian Congo	304, 036	156, 726	51, 941	27, 858	25, 787
Bolivia	8, 976, 072	3, 959, 432	5, 582, 594	2, 450, 771	2, 269, 888
Brazil	4, 389, 719	2, 298, 528	2, 367, 507	1, 316, 584	1, 186, 931
British East Africa	22, 141	12, 292			
Canada	752	380			
Chile	55, 986	29, 928			
China	48, 656	25, 073	48, 656	25, 073	40, 300
Cuba	18, 795	8, 926			
India and Dependencies	65	33	65	33	51
Mexico	350, 463	130, 120	258, 756	91, 137	60, 145
New Zealand	270, 414	128, 899			
Peru	669, 347	335, 000	187, 140	98, 014	95, 316
Portugal	336, 154	157, 213			
Southern Rhodesia	420, 947	210, 308			
Spain	500, 760	246, 962			
Union of South Africa	127, 362	66, 253			
	18, 147, 172	8, 639, 374	[3] 9, 936, 544	[3] 4, 773, 861	[3] 4, 579, 577

[1] Comprises ore and concentrates received in the United States; part went into consumption during year, and remainder entered bonded warehouses.

[2] Comprises ore and concentrates withdrawn from bonded warehouses during year (irrespective of time of importation) and receipts during year for consumption.

[3] In addition, 611,348 pounds containing 331,510 pounds of tungsten and valued at \$317,635 were imported or smelting, refining, and export.

[4] A unit, as applied to tungsten ores, is 1 percent of a ton of tungsten trioxide (WO_3). Thus, a short-ton unit is 20 pounds of WO_3 or 15.86 pounds of tungsten (W).

1945 compared with 2,353,340 pounds in 1944. Exports of tungsten salts and compounds were 7,872 pounds in 1945 compared with 2,485 pounds in 1944. Exports of tungstic acid were 123 pounds in 1945 compared with none in 1944.

CONSUMPTION

Consumption of tungsten ore and concentrates in the United States was about 14,900 short tons (60 percent WO_3 basis) in 1945 compared with 20,100 tons in 1944. Of the total consumed in 1945, 7,400 tons (50 percent) were converted to ferrotungsten, the form in which most of the tungsten is introduced into steel. However, high-purity tungsten concentrates are charged directly to the steel bath; and 2,000 tons (13 percent of the total) were so used in 1945. Tungsten-metal powder and other tungsten products, chiefly the former, employed about 5,500 tons or 37 percent of the total ore and concentrates consumed in 1945. As shown in the following table, the production of tungsten-metal powder increased substantially in 1945 over 1944, whereas that of ferrotungsten declined drastically.

Production of specified tungsten products in the United States, 1944–45, in pounds

Product	1944		1945	
	Gross weight	Tungsten content	Gross weight	Tungsten content
Ferrotungsten	13,391,658	10,264,824	8,214,504	6,545,277
Tungsten-metal powder	4,123,867	4,117,586	4,909,061	4,900,177
Special tungsten alloys	317,684	196,277	409,040	253,200
Sodium tungstate [1]	573,721	321,280	421,704	236,085
Tungstic oxide [1]	492,966	390,233	599,828	474,092
Tungstic acid and ammonium paratungstate [1]	625,911	452,998	689,889	497,460

[1] Figures cover production for sale only and therefore exclude production as an intermediate product by producers. Probably the greater part of the production reported for tungstic acid, tungstic oxide, and ammonium paratungstate is used in making tungsten powder.

WORLD PRODUCTION

The following table shows world production of tungsten by countries from 1937 to 1945, insofar as statistics are available.

Argentina.—Argentina was displaced by Brazil as the second largest producer of tungsten in South America in 1945. Output in Argentina comes principally from San Luis and Córdoba Provinces; much smaller quantities are produced in San Juan, Catamarca, Mendoza, and La Rioja. Production was about 450 to 500 metric tons (66 percent WO_3) in 1945 compared with 2,262 metric tons (66 percent WO_3) in 1944.

Australia.—According to the Mining Magazine:[5]

The mill of King Island Scheelite, N. L., is now in production. The crushing and gravity sections of the plant came into operation in April, but the flotation section, for the treatment of slimes, has yet to be installed and some pilot work will probably be done before the final layout is decided upon.

The mine is a very large open-cut proposition, situated on King Island, in Bass Strait, and upon the restriction of tungsten supplies, following the entry

[5] Mining Magazine (London), vol. 73, No. 3, September 1945, pp. 164–165.

World production of tungsten ores, 1937–45, by countries, in metric tons of concentrates containing 60 percent WO_3[1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945
North America:									
Canada	------	------	4	6	32	244	618	469	------
Cuba (exports)	------	------	------	(2)	(2)	7	7	------	10
Mexico	33	76	229	216	191	193	516	336	134
United States (shipments)	3,175	2,761	3,889	4,825	5,957	8,467	10,836	9,329	5,185
	3,208	2,837	4,122	5,047	6,180	8.911	11,977	10,134	5,329
South America:									
Argentina	866	1,195	1,309	1,417	1,720	2,115	2,420	2,488	523
Bolivia (exports)	1,802	2,530	3,337	4,183	4,353	5,606	6,902	7,935	3,851
Brazil (exports)	6	2	7	9	35	9	1,264	2,221	2,242
Chile	18	5	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Peru	78	170	170	290	337	510	722	635	317
	2,770	3,902	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Europe:									
France	------	22	(2)	109	95	76	100	62	(2)
Great Britain: Cornwall	148	258	188	201	127	198	237	350	(2)
Italy	3	4	2	2	1	(2)	(2)	(2)	(2)
Norway	3	19	31	10	8	7	(2)	4	(2)
Portugal	2,069	2,810	3,851	4,858	5,834	5,220	7,477	4,088	------
Spain	250	215	368	393	415	1,462	3,902	2,393	215
Sweden	127	180	200	(2)	(2)	(2)	(2)	(2)	------
	2,600	3,508	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Asia:									
Burma	6,894	7,090	8,238	(2)	(2)	(2)	(2)	(2)	(2)
China (exports)	17,895	13,387	11,580	3,118	(2)	8,624	12,040	8,987	(2)
India, British	15	12	(2)	44	77	87	85	(2)	(2)
Indochina: Tonkin	648	545	510	392	(2)	[3] 130	(2)	(2)	(2)
Korea (Chosen)	1,590	2,625	(2)	(2)	(2)	(2)	(2)	10,155	(2)
Malay States:									
Federated	1,077	749	246	108	(2)	(2)	(2)	(2)	(2)
Unfederated	279	333	362	427	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	(4)	(4)	2	(4)	(2)	(2)	(2)	(2)	(2)
Thailand	221	251	378	400	(2)	(2(	(2)	(2)	(2)
	28,618	24,992	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Africa:									
Belgian Congo	------	------	------	63	123	315	467	433	322
Egypt	193	(2)	------	15	43	17	42	16	(2)
Morocco, French	------	7	4	(2)	(2)	(4)	------	(2)	(2)
Nigeria	9	49	237	131	(2)	[5] 69	75	30	(2)
Southern Rhodesia	275	329	270	246	264	504	806	757	287
South-West Africa	41	48	50	24	116	115	188	119	7
Tanganyika Territory (exports)	2	5	(4)	2	1	2	3	------	(2)
Uganda	2	2	2	(2)	------	7	33	95	92
Union of South Africa	40	127	100	105	142	400	430	660	[6] 400
	562	(2)	663	(2)	(2)	(2)	(2)	(2)	(2)
Oceania:									
Australia:									
New South Wales	66	124	117	76	95	52	75	53	(2)
Northern Territory	345	480	342	314	333	159	193	102	140
Queensland	110	193	93	129	137	217	176	219	(2)
Tasmania	345	400	477	607	577	475	463	300	800
New Zealand	28	54	49	88	79	73	121	157	(2)
	894	1,251	1,078	1,214	1,221	976	1,028	831	(2)
	38,653	[7] 38,000	[7] 40,000	(2)	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed, tungsten ore is produced in Japan, U. S. S. R., and Western Australia, but data on production are not available.
[2] Data not available.
[3] January to June, inclusive.
[4] Less than 1 ton.
[5] Exports.
[6] January to September, inclusive.
[7] Estimate.

of Japan into the war, the Commonwealth Government supplied finance and technical direction for the increase of the mine output. * * * Diamond drilling carried out in the early stages proved 1,293,000 tons of ore having an average grade of 0.75 percent WO_3 and in connection with mining by open cut 917,400 tons of rock overburden and 227,700 tons of sand must be removed. * * * The daily output of ore will approximate 800 tons. * * * The estimated tonnage of ore reserves is sufficient for full-scale operation for five years, but does not represent the full mineral resources of the area, as a large section of the property still remains unexplored.

The problem of future marketing in the face of peacetime competition from other producing countries and decreased demand for tungsten will be a difficult one. The Government, to which the company is under contract (until six months after the end of the war with Japan), has asked the company to revert to half-scale production, but the request has been declined and a full rate of output is to be continued during the term of the contract. * * *

During the year ended October 31, 1945, the King Island Scheelite, N. L., milled 89,518 long tons of ore, which yielded 434 long tons of concentrates.

Bolivia.—Bolivia continues to be the largest tungsten producer in South America. Most of the deposits are in the Departments of La Paz, Oruro, Potosí, and Cochabamba. Output (as indicated by exports) was 3,851 and 7,935 metric tons (60 percent WO_3 basis), respectively, in 1945 and 1944.

The Chicote tungsten deposit in the Department of Oruro has been described by Ahlfeld.[6]

Brazil.—Brazil, which became an important producer of tungsten in 1943 as a result of the discovery (early in 1942) of deposits of scheelite in the States of Paraíba and Rio Grande do Norte, displaced Argentina as the second-largest producer in South America in 1945. Exports were 2,039 metric tons (66 percent WO_3) in 1945 and 1,989 tons (67 percent WO_3) in 1944. The scheelite deposits have been described by Johnston and De Vasconcellos.[7]

China.—The following information concerning the tungsten industry in China is reported by Chong.[8]

Given adequate power and machinery China can supply the whole world's requirements of tungsten at a remarkably low price. Even with the handicap of the entire absence of modern equipment, China has been the lowest cost producer. Its peak production touched 16,000 tons in 1940 to meet the needs of the United Nations.

The only mechanical equipment of the industry is the magnetic separator to remove tin impurities. This was an innovation introduced by the Chinese Government after taking over the control of the industry in 1936.

The Chinese Government has also done some development work but has not introduced mechanical mining yet. In fact, mining is still carried on by private mining groups on partnership basis but the ore is sold to the Government.

Mining is carried out only along the outcrop. The workings are largely confined to the upper levels and their narrow shafts or tunnels seldom exceed 200 yards in length as depth means higher transportation cost. Some of them are mere holes so small that the miners have to crawl along. The shafts or tunnels follow the richer payshoots without any regard to system with the result that many veins of economic values have been abandoned or buried for the sake of quick returns of the richer veins, thus causing enormous waste of valuable resource. With the development by the Government of crosscut tunnels through the country rock at a low level which, with raises and winzes, provide better

[6] Ahlfeld, Federico, The Chicote Tungsten Deposit, Bolivia: Econ. Geol., vol. 40, No. 8, September–October 1945, pp. 394–407.

[7] Johnston, W. D., Jr., and De Vasconcellos, F. M., Scheelite in Northeastern Brazil: Econ. Geol., vol. 40, No. 1, January–February 1945, pp. 34–50.

[8] Chong, T. Y., Modernization of Chinese Mining: Am. Metal Market, vol. 53, No. 6, January 9, 1946, p. 5.

haulage ways and ventilation, the separate private mining groups are able to extend their upper workings to greater depths.

The ore dressing is extremely simple. Instead of a huge mechanical jaw-crusher, the Chinese miners wield a hammer to break up the ore. The coarse ore is then put into baskets for jigging in a big tub of water. The baskets have bamboo screens as bottoms. The jigging process is repeated several times, the gangue being scraped off each time. The fines that accumulate is a concentrate of 50 percent WO_3 which is sold to the Government redressing plant where further treatment consists in additional jigging and regrinding and then the removal of tin impurities by a magnetic separator. The ore is finally roasted in a specially-constructed furnace which drives out the arsenic. The final product is a high-grade concentrate assaying about 70 percent WO_3, less than 1 percent tin, and about 0.1 percent arsenic.

Most of the deposits are situated in very inaccessible places not served by highways hence all supplies and ore have to be carried by coolies, pack mules or bullock carts.

The most outstanding deposits are in Kiangsi Province, namely, Si-hua Shan, Kwei-Mei Shan, Ta-chi Shan, and Pan-ku Shan, all of which have the benefit of development work done by the Government during the war and it is planned to mine mechanically the first three deposits.

The mechanization of the Chinese tungsten industry will reduce cost of production at least by 50 percent apart from recovering vast quantities of molybdenum and bismuth ore.

Peru.—Through the Institute of Mining Engineering, which is maintained by the Government, encouragement is given miners of tungsten deposits in the Departments of Ancash and La Libertad and in the Provinces of Pallasca, Cabana, and Santiago de Chuco. A 30-ton tungsten concentrator is operated near Callao by the Peruvian Government.

Production of tungsten in Peru was 317 metric tons (60 percent WO_3 basis) in 1945 compared with 635 tons in 1944.

The tungsten deposits of Peru have been described by Knox.[9]

[9] Knox, N. B., Tungsten Deposits of Peru: Eng. and Min. Jour., vol. 146, No. 8, August 1945, pp. 95–98.

BAUXITE

By John H. Weitz and Mary E. Trought

SUMMARY OUTLINE

SUMMARY[1]

Bauxite production in the United States in 1945 dropped to an estimated [2] 1,146,785 long tons (981,372 tons, dried equivalent), the lowest since 1941 and a decline of 65 percent from the 3,322,442 tons (2,823,724 tons, dried equivalent) produced in 1944. Decreased demand, higher imports, lower exports, and consumption of some of the Government stocks contributed to the lowered output. Consumption declined 30 percent to an estimated 2,430,263 tons (dried equivalent) compared with 3,459,761 tons in 1944, largely because of the reduced rate of production of alumina for the aluminum industry. Stocks of bauxite at mines and processing plants dropped from 527,093 tons to an estimated 395,509 tons during the year, and consumers' stocks decreased from 663,346 tons on December 31, 1944, to an estimated 467,663 tons on December 31, 1945. Government-owned stock piles in Arkansas held 2,756,729 tons on December 31, 1945, compared with 2,969,367 tons at the beginning of the year.

Imports of bauxite from Surinam and British Guiana in 1945 increased 32 percent in tonnage and 37 percent in value and totaled 739,581 long tons; exports, on the other hand, decreased for the second consecutive year and totaled only 126,077 tons. Estimated world output of bauxite dropped nearly 50 percent and totaled only 3,926,000 metric tons. Nearly 60 percent of the total world production is estimated to have been mined in the Western Hemisphere in the United States and the Guianas.

[1] All domestic statistics in this chapter are expressed in long tons instead of short tons.
[2] Figures for 1945 include estimates for one of the newer producers which had not reported at the time the canvass was closed.

Salient statistics of the bauxite industry in the United States, 1942–45

	1942	1943	1944	1945
Production (crude ore) [1] ... long tons	2,602,034	6,232,883	2,823,724	[2] 981,372
Value [3]	$12,981,400	$30,659,900	$14,402,497	$5,631,335
Imports [3] ... long tons	884,217	1,547,854	560,461	739,581
Exports (including concentrates) [3] ... do	260,600	417,186	146,638	126,077
World production [2] ... do	8,291,500	13,945,200	7,358,400	3,864,000

[1] Dried equivalent of mine production.
[2] Partly estimated.
[3] As shipped.

PRODUCTION

Domestic mine production of crude bauxite in 1945 dropped sharply to an estimated 1,146,785 long tons (981,372 tons, dried equivalent), a decline of 65 percent from the 3,322,442 tons (2,823,724 tons, dried equivalent) produced in 1944. The outstanding reasons for this decline in output were decreased demand in the alumina and other industries, use of ore from stock piles, and a larger excess of imports over exports.

Production of bauxite dropped 66 percent in Arkansas and 72 percent in Alabama and increased less than 1 percent in Georgia. Some output was reported in Virginia in 1945, whereas none had been produced the preceding year. In Saline and Pulaski Counties, Ark., whence 93 percent of the 1945 production came, only seven companies operated mines during 1945.

Alabama.—Only two mining companies produced bauxite in Alabama during 1945, and a third company purchased ore for consumption in its activating plant. Alcoa Mining Co. produced crude ore from its Eufaula mines in Barbour and Henry Counties, and the

Production and shipments of crude bauxite from mines in the United States, 1941–45, by States, in long tons

State and year	Production			Shipments to processing plants, consumers, and Government stock piles		
	Crude	Dried bauxite equivalent	Value	Crude	Dried bauxite equivalent	Value f. o. b. mine
Alabama, Georgia, and Virginia:						
1941	93,572	80,854	$351,200	91,803	79,527	$345,118
1942 [1]	166,884	142,128	808,900	165,495	141,988	801,660
1943	229,607	196,393	1,227,600	224,369	192,669	1,193,759
1944	149,434	128,407	723,470	153,999	132,362	751,557
1945	83,326	70,960	394,157	84,890	72,311	395,717
Arkansas:						
1941	991,481	856,196	4,324,300	945,317	817,768	4,124,134
1942	2,852,051	2,459,906	12,172,500	2,712,732	2,337,784	11,576,098
1943	7,053,028	6,036,490	29,432,300	6,825,911	5,818,508	28,487,923
1944	3,173,008	2,695,317	13,679,027	3,128,588	2,657,463	13,465,057
1945 [2]	1,063,459	910,412	5,237,178	1,264,468	1,083,517	5,676,911
Total United States:						
1941	1,085,053	937,050	4,675,500	1,037,120	897,295	4,469,252
1942	3,018,935	2,602,034	12,981,400	2,878,227	2,479,772	12,377,758
1943	7,282,635	6,232,883	30,659,900	7,050,280	6,011,177	29,681,682
1944	3,322,442	2,823,724	14,402,497	3,282,587	2,789,825	14,216,614
1945 [2]	1,146,785	981,372	5,631,335	1,349,358	1,155,828	6,072,628

[1] Includes Mississippi. [2] Partly estimated.

Recovery of processed bauxite in the United States, 1941–45, in long tons

Year	Crude ore treated	Processed bauxite recovered			
		Dried	Activated, calcined, or sintered	Total	Dried bauxite equivalent
1941	922,691	563,906	145,510	709,416	794,913
1942	1,734,761	1,212,964	166,058	1,379,022	1,458,374
1943	2,546,849	1,904,328	344,187	2,248,515	2,402,401
1944	1,408,344	964,613	152,465	1,117,078	1,188,869
1945	874,180	522,533	132,525	655,058	719,416

Barbour Bauxite Co. operated its mines near Eufaula in Barbour County. The ore was sold in crude, dried, and activated form to the alumina, refractory, chemical, and oil-refining industries. A drying plant was operated by Alcoa Mining Co. and an activating plant by Floridin Co. No production of ore was reported in 1945 by the four other companies that operated in 1944.

Arkansas.—Alcoa Mining Co. produced high-grade bauxite from its Drury mine near Sweet Home, Pulaski County, for sale to the nearby Drury calcining plant of its affiliate, Aluminum Ore Co., which calcined the ore for sale to the abrasive industry. In Saline County the company dried and calcined ore at its facilities near Bauxite for sale to alumina, abrasive, and other plants. Numerous underground and open-pit mines were operated by Alcoa in the vicinity of Bauxite. American Cyanamid & Chemical Corp. mined ore from the Heckler, Rauch Extension, Rauch Leased, and Berger No. 100 mines near Berger, Pulaski County. The Keod, Leonoro, Kathleen, Elizabeth, Pickens and Selby, and England mines in the same county were returned by American Cyanamid to the original owners on expiration of the respective leases, July 5, 1945. The company continued operation of its rotary, gas-fired, drying plant during the year near Berger. Near Bauxite, Saline County, the company drying and calcining plants were dismantled, and no further operation is contemplated. There was no production of bauxite in Saline County by American Cyanamid, and the company reported that its Globe No. 28, Cleveland, Quapaw, Ozark No. 24, and Ozark No. 28 mines in that county have been abandoned.

Neither the Bierman mine in Pulaski County nor the Alexander No. 2 mine in Saline County was operated in 1945 by Consolidated Chemical Industries, Inc., although the company continued to ship ore from stock piles on both properties. Crouch Mining Co. mined high-grade ore from its Young mine in Saline County and processed all output in its drying and calcining plant near Bauxite. The Brown-Ratcliffe lease of the Dulin Bauxite Co. was surrendered to the owners on October 10, 1945; the mine was reported exhausted. The Thorpe and Harley leases were exhausted, and no ore was produced from them in 1945; however, the leases were not reported surrendered. The Dulin Bauxite Co., Inc., produced ore from the Penzel and Coe mine (although it was in operation only 4 months owing to the labor shortage) and from the Dixie and Brown-Ratcliffe mines during 1945. The company sold crude ore to the Metals

Reserve Company (since July 1, Office of Metals Reserve, Reconstruction Finance Corporation) and crude and calcined bauxite to the abrasive and other industries. Production from the Childress mine of the Macke Mining Co. ceased entirely after January 1945; all ore was sold to Metals Reserve Company. Both the calcining plant and the Norton mine of the Norton Co. operated during 1945 to produce bauxite for the abrasive industry. Reynolds Mining Corp. operated the Hurricane and Covington mines in 1945.

Georgia.—In Georgia both American Cyanamid & Chemical Corp. and Alcoa Mining Co. operated mines and drying plants during 1945. Cyanamid produced bauxite from the Hatton & Thig Pen mines in the Andersonville district, Sumter County, and Alcoa worked its mines in the Hermitage area of Floyd County. All ore was shipped to the alumina and chemical industries in dried form. The Dupont mine of American Cyanamid & Chemical Corp. at Reesburg, Floyd County, was reported as abandoned during the year, as was the Lane McMichael mine at Oglethorpe, Macon County. No other producers were active in Georgia in 1945.

Oregon.—Aluminum Co. of America announced in its 1945 Annual Report that the company conducted extensive research on the utilization of low-grade laterite ore, large quantities of which have been reported in Oregon, for the production of alumina. The work is said to offer promise, and investigations are being continued.

Virginia.—Mine production at the Lightner, Allen, and Harris mines near Spottswood, Augusta County, was resumed by Alcoa Mining Co. in 1945, and ore was shipped to industry in crude form.

STOCKS

Stocks of bauxite (dried equivalent) on hand at mines and processing plants on December 31, 1945, totaled an estimated 395,509 long tons, compared with 527,093 tons (revised figure) on December 31, 1944. Stocks at consumers' plants decreased from 663,346 tons at the end of 1944 to an estimated 467,663 tons at the end of 1945. Government-owned stocks of bauxite held by Office of Metals Reserve, totaled 2,756,729 tons on December 31, 1945, compared with 2,969,367 tons on December 31, 1944, a decrease of 212,638 tons or 7 percent.

CONSUMPTION

Consumption totaled an estimated 2,430,263 long tons (dried equivalent) in 1945 compared with 3,459,761 tons in 1944, a decline of 30 percent. The consumption figures for both years include calcined bauxite shipped for export to American-owned abrasive plants in Canada for the manufacture of crude abrasives, which are returned to the United States for final manufacture and consumption. Of the 2,430,263 tons of bauxite consumed in 1945, the alumina industry is estimated to have used 84 percent or 2,049,934 tons, the chemical industry 6 percent or 134,766 tons, abrasive and refractory industries 8 percent or 201,182 tons, and the cement, oil-refining, and steel and ferro-alloy industries 2 percent or 44,381 tons. Consumption of bauxite as shipped is estimated to have totaled 2,492,520 tons and consisted of 968,457 tons of crude ore, 1,383,243 tons of dried ore, 125,845 tons of calcined ore, and 14,975 tons of activated ore. Of the bauxite consumed (dried-equivalent basis), it is estimated that 30 percent was foreign and 70 percent domestic. Of the foreign ore consumed, the alumina industry is estimated to have used 92 percent and the chemical, abrasive, cement, and other industries the remaining 8 percent.

Domestic consumption, shown in the following table, is presented upon two different bases. Apparent consumption within the United States does not correspond with the data above, inasmuch as calculations are based upon shipments to domestic plants and do not consider fluctuations in consumers' stocks (including Government-owned stock piles). Although partly estimated for 1945, actual consumption, including shipments to Canada for processing, is based upon monthly consumer surveys and eliminates shipments destined to stock piles.

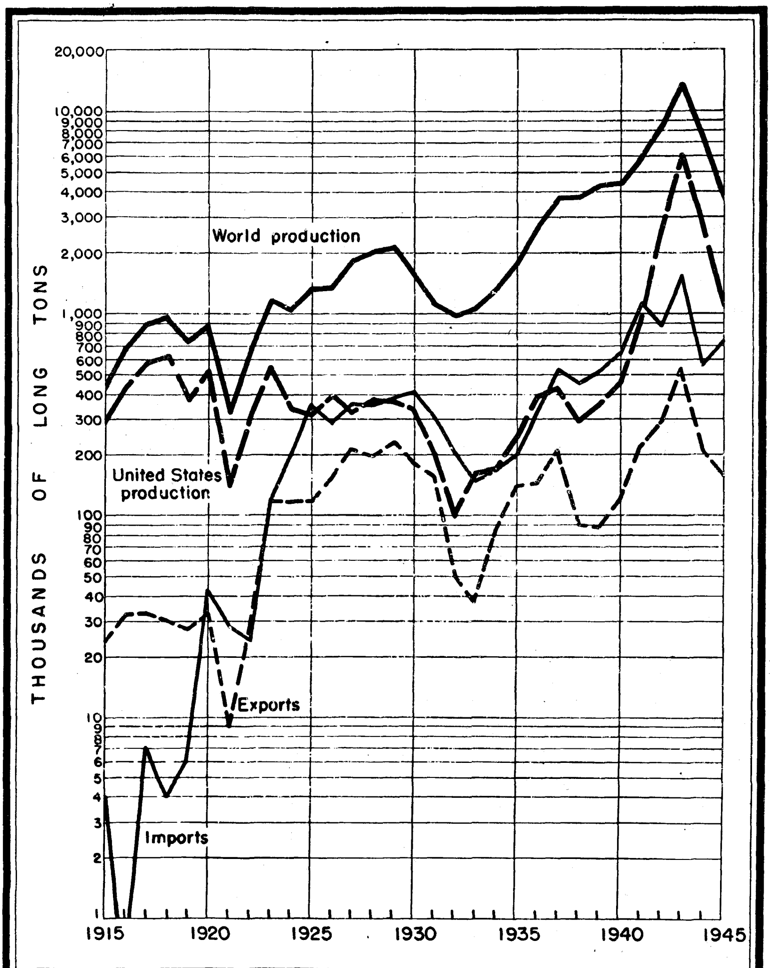

FIGURE 1.—Trends in domestic production, imports, exports, and world production of bauxite, 1915-45.

Shipments, imports, exports, and consumption of bauxite in the United States, 1941–45, in long tons

[Dried-bauxite equivalent]

Year	Domestic shipments from mines and processing plants to industry: Arkansas	Alabama, Georgia, and Virginia	Total	Imports	Exports	Apparent consumption within United States	Actual consumption [1]
1941	857, 804	79, 812	937, 616	1, 116, 546	218, 691	1, 835, 471	1, 721, 475
1942	2, 311, 283	[2] 137, 199	2, 448, 482	884, 217	294, 176	3, 038, 523	2, 518, 325
1943	5, 765, 491	182, 350	5, 947, 841	1, 541, 929	528, 839	6, 960, 931	4, 760, 848
1944	2, 568, 770	129, 568	2, 698, 338	555, 647	210, 852	3, 043, 133	3, 459, 761
1945	[3] 1, 002, 695	80, 567	[3] 1, 083, 262	737, 081	156, 129	[3] 1, 664, 214	[3] 2, 430, 263

[1] Includes exports to Canada, inasmuch as virtually all of this bauxite is shipped to American-owned plants in Canada for manufacture into crude abrasives reimported into the United States for final manufacture and consumption.
[2] Includes Mississippi.
[3] Partly estimated.

BY INDUSTRIES

The following table shows only shipments of domestic bauxite to consuming industries and excludes foreign ore.

Bauxite shipped from mines and processing plants in the United States, 1942–45, by consuming industries, in long tons

Industry	1942: As shipped [1]	1942: Dried bauxite equivalent	1943: As shipped [1]	1943: Dried bauxite equivalent	1944: As shipped [1]	1944: Dried bauxite equivalent	1945: As shipped [1]	1945: Dried bauxite equivalent
Alumina	[2] 2, 183, 361	[2] 2,023,963	[3] 6, 075, 631	[3] 5, 404, 159	[4] 2, 628, 481	[4] 2, 335, 137	[5] 833, 478	[5] 772, 250
Chemical	164, 111	156, 095	244, 446	241, 851	128, 503	127, 526	98, 664	97, 029
Abrasive [6]	151, 839	224, 551	178, 341	258, 381	143, 389	209, 135	117, 493	174, 338
Oil refining, refractory, [6] and other	42, 291	43, 873	38, 902	43, 450	20, 179	26, 540	33, 078	39, 645
Total quantity	2, 541, 602	2, 448, 482	6, 537, 320	5, 947, 841	2, 920, 552	2, 698, 338	1, 082, 713	1, 083, 262
Total value	$13, 672, 727		$33, 372, 382		$15, 814, 431		$7, 471, 618	

[1] Includes crude, dried, calcined, activated, and sintered.
[2] Includes 600,000 tons (522,000 dried equivalent) shipped to Metals Reserve Company stock piles.
[3] Includes 3,384,874 tons (2,852,773 dried equivalent) shipped to Metals Reserve Company stock piles.
[4] Includes 1,594,487 tons (1,332,673 dried equivalent) shipped to Metals Reserve Company stock piles.
[5] Includes 400,096 tons (339,052 dried equivalent) shipped to Metals Reserve Company stock piles.
[6] Small quantity of bauxite shipped to makers of refractories probably included under "Abrasive."

Alumina.—Bauxite consumption by the alumina industry in 1945 decreased approximately 32 percent from that in the previous year, totaling an estimated 2,049,934 tons compared with 3,033,903 tons in 1944. Of all the bauxite consumed in 1945, the alumina industry used 84 percent compared with 87.7 percent the preceding year. Domestic bauxite consumed totaled 1,383,075 tons (estimated) or 67 percent, whereas foreign ore consumed totaled 666,859 tons (estimated) or 33 percent. The industry employed crude and dried ore from Alabama, Arkansas, Georgia, Surinam, and British Guiana. Not all bauxite consumed by the alumina industry is destined to emerge finally as aluminum metal, since some of the alumina is used by the chemical, abrasive, and refractory industries, and some of it is processed into special products, such as activated and tabular aluminas for use in the oil-refining and ceramic industries.

Chemical.—The chemical industry used an estimated 6 percent of all domestic and foreign bauxite consumed in 1945; consumption in the industry increased less than 1 percent, exclusive of ore used to produce alumina for chemical purposes. Shipments of domestic bauxite from mines and processing plants to the chemical industry decreased 24 percent from 1944. Consumption by the industry totaled 134,766 long tons, but this included ore used to make some aluminum chemicals other than those shown in the following table. Ore used to manufacture the aluminum salts and alumina shown in the table totaled 258,205 tons, of which 211,273 tons (82 percent) were domestic, and 46,932 tons (18 percent) were foreign bauxite. In addition to bauxite, producers of aluminum salts reported consuming 13,249 short tons of commercial aluminum trihydrate, 13,523 tons of secondary aluminum, 91,073 tons of clay, and a quantity of alunite and bichromate residue.

Production of aluminum salts decreased 3 percent, whereas shipments decreased 2 percent in quantity and 8 percent in value in 1945. Output of alumina (aside from that used in making aluminum) decreased 16 percent, and shipments decreased 14 percent. Of this alumina, 20 percent was consumed by aluminum salts producers; the remainder was used by manufacturers of abrasives, refractories, petroleum products, spark plugs, glass, rubber, paints, and various other commodities.

Aluminum salts and alumina produced and shipped in the United States, 1944–45

	1944				1945			
	Production	Shipments			Production	Shipments		
	Short tons	Shippers	Short tons	Value	Short tons	Shippers	Short tons	Value
Aluminum salts:								
Alum:								
Ammonia	7,999	6	7,744	$515,637	8,460	6	8,528	$579,583
Potash	4,530	5	4.049	303,404	4,844	4	5,170	395,859
Aluminum chloride:								
Liquid	5,468	4	5,513	240,856	5,520	4	5,097	257,256
Crystal Anhydrous	24,443	3 7	24,163	3,863,946	21,036	3 7	20,892	2,929,033
Aluminum sulfate:								
Commercial:								
General	566,322	19	555,047	12,751,763	545,209	19	540,030	11,825,418
Municipal	12,145	7	12,142	242,311	12,062	8	12,011	236,729
Iron free	24,193	5	23,476	877,597	29,731	6	29,400	1,053,104
Sodium aluminum sulfate Sodium aluminate	28,810	2 13	28,154	1,946,512	28,842	2 12	28,943	1,892,509
Total aluminum salts	673,910	------	660,288	20,742,026	655,704	------	650,071	19,169,491
Alumina [1]	77,971	10	78,168	7,084,979	65,117	10	66,895	5,187,433

[1] Excludes alumina produced for use in making aluminum; includes activated, calcined, crude, light and heavy hydrate, converted to a calcined alumina equivalent.

Aluminum salts shipped in, imported into, and exported from the United States, 1941–45

	Domestic shipments		Imports		Exports			
					Aluminum sulfate		Other aluminum compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	626,384	$17,382,675	(1)	$231	51,261	$1,184,169	2,815	$349,951
1942	604,487	17,723,343	(1)	4	44,428	1,103,340	2,384	354,397
1943	642,327	20,233,370	3	941	37,946	963,151	2,922	307,288
1944	660,288	20,742,026			41,434	1,072,140	3,802	528,821
1945	650,071	19,169,491			37,972	993,869	4,106	530,350

[1] 147 pounds in 1941 and 50 pounds in 1942.

Abrasive and refractory.—Manufacturers of crude aluminous abrasive pigs in Canada and the United States and manufacturers of bauxite refractories in the United States used 201,182 tons (8 percent) of all the foreign and domestic bauxite consumed in 1945, a 23-percent decrease from the 260,761 tons used in 1944. Except for a relatively small quantity from British Guiana, all the ore requirements of the industry were supplied from Saline and Pulaski Counties, Ark.

Other.—Consumption of bauxite in the cement, steel and ferro-alloy, and oil-refining industries decreased 52 percent in 1945.

PRICES

In 1945 the average selling price, f. o. b. mines and processing plants, was estimated at $4.50 a long ton for crude (undried) bauxite, $5.93 for crushed dried bauxite, $14.29 for calcined bauxite, and $53.80 for activated bauxite. Prices in 1944 were as follows: $4.33 for crude, $5.59 for dried, $14.17 for calcined, and $56.67 for activated. The average price for all grades of domestic ore as shipped was $6.90 a long ton ($5.43 in 1944). Nominal market quotations, given in the following table from E&MJ Metal and Mineral Markets, remained static throughout 1945 for all grades of domestic bauxite.

The Metals Reserve Company purchases of ore in Arkansas were under the same price schedule as that in effect during 1944 and shown in Minerals Yearbook, 1944. The schedule is based on percentages of contained alumina, silica, and ferrous iron. The base price is $4.15 a long ton for ore containing 50 percent Al_2O_3, 13 percent SiO_2, and less than 6 percent FeO. Bonuses are as follows: 20 cents a ton for each percent of silica under 13, and 14 cents a ton for each percent of alumina over 50. Penalties are as follows: 43 cents a ton for each percent of silica over 13; 14 cents for each percent of alumina under 50; and 43 cents for each percent of iron in the ferrous state, calculated as FeO, over 6 percent. This price schedule has been in effect since September 1943.

Range of quotations on bauxite, 1942–45

Type of ore	Chemical specifications (percent)		Prices during year		
	Al_2O_3	SiO_2	1943	1944	1945
Domestic ore (per long ton):					
Crude [1]	50–52	(2)	$5.00	$5.00	$5.00
Chemical, crushed and dried [3]	55–58	(4)	$7.50– 8.50	$7.50– 8.50	$7.50– 8.50
Other grades [1]	56–59	5– 8	7.50– 8.50	7.50– 8.50	7.50– 8.50
Pulverized and dried [1]	56–59	8–12	14.00–16.00	14.00–16.00	14.00–16.00
Abrasive grade, crushed and calcined [1]	78–84	(4)	16.00	16.00	16.00
Foreign ore (per metric ton):					
Dalmatian [5]	50–55	1– 3	(6)	(6)	(6)
Greek [5]	56–58	3– 5	(6)	(6)	(6)
French [5]	56–59	2– 4	(6)	(6)	(6)

[1] F. o. b. Arkansas mines.
[2] Not specified.
[3] F. o. b. Alabama and Arkansas mines.
[4] SiO_2 not specified; Fe_2O_3, 1.5–2.5 percent.
[5] C. i. f. Atlantic ports.
[6] Not published after Feb. 6, 1941.

FOREIGN TRADE [3]

Imports of bauxite in 1945 (739,581 long tons) increased 32 percent in tonnage and 37 percent in value over those in 1944 (560,461 tons). Exports dropped for the second consecutive year, totaling only 126,077 tons valued at $2,424,921, compared with 146,638 tons valued at $2,928,799 in 1944. Of the 1945 imports, 713,854 tons came from Surinam and the remaining 25,727 tons from British Guiana, according to the United States Department of Commerce. By customs districts, imports were as follows: 683,705 tons at Mobile, 30,909 tons at Philadelphia, 14,262 tons at New Orleans, 10,705 tons at Massachusetts, and less than 1 ton at Connecticut.

Bauxite imported into and exported from the United States, 1941–45

Year	Imports for consumption [1] [2]		Exports (including bauxite concentrates) [3]		Year	Imports for consumption [1] [2]		Exports (including bauxite concentrates) [3]	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1941	1,116,546	$7,475,039	134,746	$2,773,877	1944	560,461	$3,844,315	146,638	$2,928,799
1942	884,217	5,952,451	260,600	5,086,695	1945	739,581	5,273,122	126,077	2,424,921
1943	1,547,854	10,860,149	417,186	5,575,128					

[1] Also "alumina" as follows: 1941: 60 tons, $5,544; 1942: 21,711 tons, $1,570,377; 1943: 12,372 tons, $1,108,104; 1944: Less than 1 ton, valued at $1; 1945: 179 tons, $10,940.
[2] Chiefly dried ore.
[3] As shipped.

Of the 1945 exports, 111,908 long tons were classified as bauxite and other aluminum ores and 14,169 tons as bauxite concentrates (including alumina). Canada was the largest recipient of the exports, 111,655 tons of bauxite and other aluminum ores having been shipped to that country; only 197 tons went to Curaçao, 56 tons to

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

U. S. S. R., and less than 1 ton to Mexico. Aside from shipments to Canada for abrasive manufacture, the exports consisted almost entirely of activated bauxite destined for use in oil refineries. Bauxite concentrates (including alumina) were exported to the following countries: Canada 13,913 tons, Dominican Republic 107, Cuba 76, Curaçao 54, U. S. S. R. 10, and less than 10 each to the United Kingdom, Mexico, Australia, Brazil, and Argentina.

WORLD PRODUCTION

Estimated world output of bauxite dropped nearly 50 percent for the second consecutive year and totaled only 3,926,000 metric tons in 1945. Reliable data on central European and Far Eastern countries are not available in most instances. Nearly 60 percent of the total world production is estimated to have been mined in the Western Hemisphere by the United States and the Guianas.

World production of bauxite, 1940–45, by countries, in metric tons

	1940	1941	1942	1943	1944	1945
Australia:						
New South Wales	2,081	2,671	1,832	734	2,058	[3] 2,000
Victoria	1,446	2,793	1,655	1,855	1,842	1,792
Brazil	82	14,365	29,890	[2] 76,761	[2] 2,979	[2] 7,061
British Guiana	634,510	1,060,979	1,215,744	1,919,060	928,178	667,764
France	489,020	587,420	639,560	916,350	665,638	[3] 200,000
Germany	[3] 20,000	[3] 25,000	[3] 25,000	[3] 25,000	[3] 25,000	(1)
Gold Coast	----	14,886	44,767	162,685	107,854	[3] 120,000
Greece	[3] 50,000	10,000	50,000	50,000	10,000	(1)
Haiti	----	----	----	----	----	300
Hungary	[3] 700,000	720,000	1,038,000	1,000,000	900,000	(1)
India, British	8,154	13,170	18,551	24,548	(1)	(1)
Indochina	118	[3] 3,500	[3] 3,500	(1)	(1)	(1)
Italy	[3] 530,000	542,881	509,430	(1)	(1)	2,584
Jamaica	----	----	----	2,642	----	----
Japan (mandated islands)	[3] 22,500	[3] 59,000	[3] 14,000	[3] 85,000	[3] 4,500	----
Netherlands Indies	274,345	171,821	[3] 275,000	[3] 600,000	[3] 275,000	(1)
Portuguese East Africa	1,030	1,352	1,860	3,272	6,177	[3] 5,000
Rumania	10,300	9,800	15,000	11,010	(1)	(1)
Spain	271	1,383	2,214	[3] 2,400	2,921	[3] 3,500
Surinam	615,434	1,198,900	1,227,512	1,655,147	625,804	[2] 683,990
Unfederated Malay States (Johore)	63,787	[3] 25,000	[3] 55,000	[3] 140,000	[3] 55,000	(1)
U. S. S. R.	[3] 300,000	[3] 250,000	[3] 275,000	[3] 350,000	[3] 400,000	[3] 400,000
United Kingdom	----	13,090	97,260	109,656	44,502	[3] 35,000
United States (dried equivalent) [4]	446,253	952,082	2,643,775	6,332,868	2,869,021	997,123
Yugoslavia	290,000	231,400	240,000	[3] 200,000	[3] 150,000	(1)
	4,459,300	5,911,500	8,424,600	14,169,000	7,476,500	3,926,000

[1] Data not available. Estimate included in total.
[2] Exports.
[3] Estimated production. Estimates by authors.
[4] Mine production of crude ore; 1945 partly estimated.

REVIEW BY COUNTRIES

Brazil.—The birth of Brazil's aluminum industry has caused the tremendous undeveloped reserves of bauxite in this South American country to take on new importance to its internal economy. Formerly bauxite was used solely for manufacture of aluminum sulfate and for export, mainly to Argentina but also to the United States and the United Kingdom during the war. It is expected that domestic and export demands will increase markedly from the prewar level Bauxite was made subject to import licensing during 1945. Exports of bauxite from Brazil in 1945 totaled 7,061 metric tons compared to an estimated production of about 11,000 tons.

British Guiana.—Exports of bauxite in 1945 dropped about 15 percent from 1944 and totaled 738,544 long tons. They were lower than in any year since 1940 but were greater than in any year before the war. During the last quarter of 1945, however, shipments declined to about 30,000 tons a month compared with an average of about 72,000 tons for the first 9 months. The Demerara Bauxite Co., controlled by the Aluminum Co. of Canada, was the major producer and shipped virtually all its output to Arvida, Quebec, Canada, for the production of alumina. Operations of the Berbice Bauxite Co., which had been suspended since early 1943, were resumed on a limited scale during the last quarter of 1945. The company is not expected to produce more than about 12,000 tons a month for the next several years.

China.—According to reports, Chinese engineers are working on development of high-grade bauxite deposits recently discovered in western China. Deposits near Kunming, Yunnan, are officially estimated to contain 10,000,000 metric tons of bauxite amenable to treatment by the Bayer process.

Dominican Republic.—Concessions were obtained during 1945 for mining bauxite in the Provinces of Barahona, Bahoruco, San Rafael, Benefactor, and Samana. The concessionaire was not named. As reported in the 1944 chapter of this series, the Republic Mining & Mfg. Co. (now Alcoa Mining Co.) was conducting exploratory work in the Dominican Republic during 1944.

France.—Recent statistical data from a reliable source indicate that shipments of French bauxite during the war years were as follows (metric tons):

Year	Domestic	Export		Total
		Germany	Other countries	
1940	450,592		44,608	495,200
1941	440,514	232,055	1,915	674,484
1942	419,260	230,685	3,599	653,544
1943	436,305	480,564	1,928	918,797
1944	238,751	292,872	1,824	533,447

Production of bauxite in France during 1945 averaged between 17,000 and 20,000 metric tons a month, or about 30 percent of the 1938 average rate of production.

Germany.—Military Government reports from Germany have stated that during the war the grade of bauxite used in the German aluminum industry (largely imported from Hungary and Croatia) declined markedly. In 1938 only 2.23 metric tons of bauxite were required to make 1 ton of alumina, whereas by 1943 the ratio was 2.75 : 1. This was presumably due to the greatly increased imports of ore from Croatia and Hungary, resulting in less selective mining and a greater proportion of low-grade bauxite. The decline in grade meant that the 1,449,250 metric tons of bauxite consumed to make alumina in 1943 was 272,500 tons more than would have been required had

1938 grade been maintained. Thus the lower-grade bauxite used in Germany not only made treatment more difficult but also further overloaded transport facilities to move the required quantities from central and southern Europe. Reports indicate that the decline in quality of the bauxite used resulted in a decline in utilization of alumina capacity to 83 percent in 1943.

Imports of bauxite into Germany were as follows: 1,090,800 metric tons in 1940, 1,171,400 in 1941, 1,508,000 in 1942, 1,534,800 in 1943, 985,800 in 1944, and 45,900 in the first 2 months of 1945. Stocks of ore at alumina plants fluctuated from about 900,000 to 1,100,000 metric tons but had declined to 866,000 tons by July 1, 1944, and to 450,000 tons by February 1, 1945.

Gold Coast.—During 1945 the mines at Ejuanema near Nkawkaw were closed for an indefinite period, and most of the year's estimated output of 120,000 metric tons came from the Kanaiyerebo mine at Awaso, Sefwi-Bekwai, Western Province. Both production and exports (134,760 tons in the first 10 months) were greater than in 1944. Stocks at the port of Takoradi were maintained at a fairly uniform level and represented approximately 1 months' exports.

Greece.—Estimates indicate that there are approximately 15,000,000 tons of developed and probable bauxite reserves in Greece. This country was reported to have produced the best grade of bauxite at the lowest cost of any European country before the war. Greek partisans destroyed the plant of the most productive mine, the Topolia mine of the S. A. Mines de Parnasse, during the war, and before operations can be resumed a new 12-kilometer ropeway from the mine to the port must be constructed. The materials for this ropeway were requested by the Greek Government from United Nations Relief and Rehabilitation Administration. Mines at Eleusis and on the island of Amorgos were reported to be in working condition in August 1945 and capable of immediate resumption of operations. Reports indicate that about 200,000 tons of high-grade bauxite were exported from Greece during the German occupation.

Haiti.—The Reynolds Metals Co. is reported to have continued its exploratory work in Haiti, especially on the Rochelois Plateau, where topographic surveys and test drillings have been carried out. The company has also built an access road and rehabilitated an old road in the area. Production in 1945 was recorded as 300 long tons for experimental purposes.

Hungary.—Recent estimates of bauxite reserves in Hungary range from 116,000,000 to 400,000,000 metric tons, but according to a reliable source only 24,000,000 tons are proved ore containing 50 to 55 percent alumina and less than 6 percent silica. No data are available on 1945 output, but it is not likely that more than one-third as much ore was produced as in 1944 (900,000 metric tons, estimated) owing to the complete transport break-down early in the year and to the Red Army occupation. Late in 1945 it was reported that bauxite was being shipped to Poland in exchange for coke.

Italy.—Bauxite mining was resumed on a small scale at Foggia in southern Italy late in 1945.

Japan.—The following table shows the imports of bauxite and aluminous shale into Japan and Formosa from 1940 to 1945. It is noteworthy how heavily the Japanese were forced to rely on the in-efficient and costly use of shale from North China, when their southern shipping routes grew increasingly subject to losses.

Imports, in metric tons

Fiscal year beginning Apr. 1	Bauxite				Aluminous shale from North China
	Bintan	French Indochina	Malay States	Palau	
1940	194,729		62,965	22,495	41,760
1941	58,059	3,215	26,140	59,297	59,649
1942	274,449		55,831	13,097	44,609
1943	594,589		138,555	84,940	48,323
1944	277,782		55,065	4,488	154,739
1945 [1]	1,800				38,902

[1] April to June.

Nyasaland.—Sampling of the Mlanje bauxite deposits by the Geological Survey, Department of the Nyasaland Protectorate, showed that most of the ore is high in silica and low in alumina. An average of 160 samples had 41.6 percent alumina, 14.2 percent ferric oxide, 19.6 percent silica and silicates, 1.5 percent titania, and 23.1 percent loss on ignition. The report suggested that flotation might lower the silica content to a point where the ore would be commercial. Deposits have been found over a total area of 3½ square miles, with depth ranging generally from 15 to 30 feet.

Surinam.—The bauxite deposits of Surinam (Netherlands Guiana) were heavily drawn on during the war years, having produced over 5,200,000 metric tons from 1941 to 1945, inclusive. Reserves are, however, reported still to be very large in blocked-out areas, probably representing only a small part of the total. Little exploration of new fields has been undertaken in recent years, and some of the known, though unexploited, fields are too far from navigation to be commercially important at present. Surinamsche Bauxite Maatschappij, subsidiary of the Aluminum Co. of America, is said to control the major share of the known workable deposits of bauxite in Surinam. Reserves of the company have never been disclosed to the public, but the mines at Moengo have been worked continuously for 25 years. The Moengo mines are thought to be nearly worked out at present. The company is constructing a railroad from the Moengo works to a nearby deposit at Rikenau Hill, said to be larger than the former. Reserves are estimated at 60 years at the present rate of production, according to a reliable source. The mine at Paranam is reported to have ore reserves as large as those at Moengo were before exploitation. The local management of the company has announced plans for converting a drying kiln to produce calcined ore for the abrasive trade in the United States. It is understood that the company plans to produce about 70,000 tons of calcined bauxite a year.

Small deposits of ore in the Para Creek district are owned by the N. V. Billiton Maatschappij, but they are considered to be too small to warrant construction of processing plants, such as those at Moengo and Paranam. It is reported that this company may cease operations in the near future.

A third company, the Nederlandsch Guyana Bauxite Exploitatie Maatschappij, N. V., was incorporated in Surinam in 1945 and plans to exploit a deposit on the Cottica River just north of Moengo. No development work was done in 1945.

United Kingdom.—The sole source of bauxite from within the British Isles during the war was in County Antrim, Northern Ireland, where geological work located several deposits in an area formerly exploited for bauxite but believed worked out. Three mines were operated during the war period and produced about 300,000 metric tons of bauxite. Operations reached a peak in 1943, when more than 100,000 tons of ore were mined, but declined greatly in 1944 and 1945. Finally in November the Ministry of Supply and Aircraft Production decided to close down the last of the three mines at Temple Patrick, which had produced about 900 tons of ore a week during October.

ALUMINUM

By John H. Weitz and Mary E. Trought

SUMMARY OUTLINE

SUMMARY

The production of primary aluminum in the United States in 1945 is estimated [1] at 496,487 short tons, a decrease of 36 percent from the 776,446 tons produced in 1944. Domestic output came from the privately owned plants of the Aluminum Co. of America, the Reynolds Metals Co., and the Government-owned plants operated by Alcoa and Olin Corp. The decreased output resulted from lessened foreign and domestic demand after the German and Japanese surrenders. Military reverses late in 1944 on the western front in Europe made necessary a moderate production increase early in 1945, but after May output dropped steadily. Producing facilities were gradually curtailed, and the last of the Government-owned primary metal plants and the last Government-owned alumina plant were closed on October 31, 1945, leaving only the privately owned plants of Reynolds and Alcoa in operation. During the latter part of the year the most important problem facing both Government and industry was the disposal of Govenment-owned facilities, and it was still largely unsolved by the year's end.

Stocks of virgin ingot held by the Government on December 31, 1945, totaled 185,750 tons, most of which were in the United States. Total stocks of metal in primary and secondary form at producing, fabricating, and consuming plants and in the form of wrecked and obsolete aircraft are estimated to have exceeded 1,000,000 short tons at the end of 1945. Imports of crude and semicrude aluminum totaled 339,293 tons, more than 3⅓ times the 1944 imports; exports, on the other hand, decreased 97 percent in 1945 and totaled only 6,543 tons. Recovery of secondary aluminum decreased from 325,645 tons in 1944 to 298,387 tons in 1945. Apparent consumption of primary aluminum (production plus imports minus exports plus or minus changes in producers' stocks) in 1945 increased from

[1] Figures for 1945 include estimates for one of the newer producers which had not reported at the time the canvass was closed.

744,627 tons in 1944 to an estimated 796,081 tons in 1945, owing largely to the transfer of Government stocks from Canada to the United States.

World production of aluminum was estimated to have been only slightly more than half the 1944 total. The greatest declines in output were in Germany and other parts of Central Europe and in Japan and territories formerly Japanese-controlled.

Salient statistics of the aluminum industry, 1942–45

	1942	1943	1944	1945
Primary production short tons	521,106	920,179	776,446	[1] 496,487
Value	$151,371,000	$265,380,000	$222,416,000	[1] $141,924,000
Quoted price per pound [2] cents	15.0	15.0	15.0	15.0
Secondary production short tons	196,464	313,961	325,645	298,387
Imports	$37,147,891	$41,817,044	$30,322,653	$99,348,667
Exports	$26,948,686	$67,216,832	$89,796,339	$9,866,306
World production [1] short tons	1,525,800	2,123,400	1,875,600	1,009,700

[1] Partly estimated.
[2] Ceiling price.

PRODUCTION

Primary.—The output of an estimated 496,487 short tons of virgin aluminum in 1945 represents a 36-percent decline in output from the 776,446 tons produced in 1944 and is 46 percent below the all-time high of 920,179 tons in 1943. The decline resulted from gradual curtailment of operations in producing facilities; the last of the Government-owned primary metal plants shut down on October 31, 1945. Reduction of operations was due to decreased demands for aluminum in aircraft and other war material after VE-day and to further diminished requirements after VJ-day. Final shut-down of the Government-owned plants, the operation of which had been greatly reduced previously, came at the termination by the Reconstruction Finance Corporation of its operating contracts with the Aluminum Co. of America. Other factors influencing the cut-back decisions were the growing stocks of ingot held by the Government, mainly Canadian-produced metal imported in vast quantities during 1945, and substantial stocks held by producers and fabricators, both in ingot and semifabricated form.

The most important problem facing the aluminum industry and the Government during the latter part of 1945 was how to dispose of the Government-owned facilities so that the largest number would remain active and so that the industry would be in the best position to take advantage of its great postwar possibilities. On March 12, 1945, the Second Federal Circuit Court in New York, sitting as a panel of the Supreme Court under Public Law 332 (June 10, 1944), held that the New York Federal District Court had erred in finding that Alcoa had not operated in violation of section two of the Sherman Act. The reversal was, however, restricted to the virgin-aluminum-ingot situation, and in handing down its decision the court left unsettled the contention of the Government that Alcoa should be dissolved, inasmuch as the wartime construction and operation of plants had altered the situation. The court said that the need for the application of such a remedy as dissolution was for the District Court to decide and recognized that the postwar situation might be very different from that existing in 1940. In the latter part of 1945 reports on the disposal of surplus aluminum facilities were issued by the United States Department of Justice and by the Surplus Property Administration, which arrived at differing conclusions. The Department of Justice report took the position that it is virtually impossible to find industrial organizations willing to enter into competition with Alcoa and that therefore it might be best to break that company into several competing units, whereas the Surplus Property Board report took the stand that competition could be fostered only by Government subsidy in the form of favorable leases, aid in raw-material procurement, and assurance of a market to prospective newcomers.

Later in 1945 the Reynolds Metals Co. offered to lease the Hurricane Creek alumina and the Jones Mills reduction plants from the Reconstruction Finance Corporation, and by the end of the year the offer had been approved by the latter. Offers to purchase the two Government-owned Bayer alumina plants and several of the reduction plants were made by the Aluminum Co. of America, but under a ruling by the Attorney General (whose approval is necessary in the sale of the Government plants), the disposal of any Government-owned aluminum plants to Alcoa would violate the antitrust laws, unless such disposal were accompanied by relinquishment of properties now owned by Alcoa to the extent necessary to create competition. However, at the end of the year, the impasse in aluminum-plant disposal, promised to be overcome with the submission to the RFC of several lease and purchase offers. It appeared that at least two companies other than Alcoa would be important factors in the industry through the lease of Government-owned facilities. Alcoa contributed to the Government's plant-disposal program by granting RFC, for use at the Hurricane Creek alumina plant, a royalty-free license under all of the company patents covering the process of extracting alumina from bauxite. These patents are essential to the competitive operation with low-grade bauxite of the Hurricane Creek plant.

Stocks of virgin ingot aluminum held by the RFC on December 31, 1945, totaled 185,750 tons, of which 94 percent was held in the United States and the balance in Canada. The stocks of Government-owned primary metal at the end of 1945 were held under the freezing provisions of section 22 of the Surplus Property Act of 1944, which provisions were to expire January 3, 1946. Several stock-piling bills under consideration by Congress provided for the holding of a large share of the available stocks as a strategic reserve against future emergency. Total stocks of aluminum, including metal at aircraft and other consuming plants, in process and in plant inventories in the aluminum industry, and in Government stock piles, plus secondary and scrap aluminum in the hands of dealers and smelters and in the form of wrecked and obsolete aircraft at the end of 1945, have been estimated to be more than 1,000,000 tons.

Secondary.—Recovery of secondary aluminum in 1945 totaled 298,387 short tons compared with 325,645 tons in 1944 and 313,961 tons in 1943. The 298,387 tons recovered from secondary sources included 2,145 tons of pure metal (98.5+ percent), 293,967 tons of aluminum alloys, 1,162 tons of aluminum in brass and bronze, 267 tons in zinc-base alloys, and 846 tons of aluminum in chemical com-

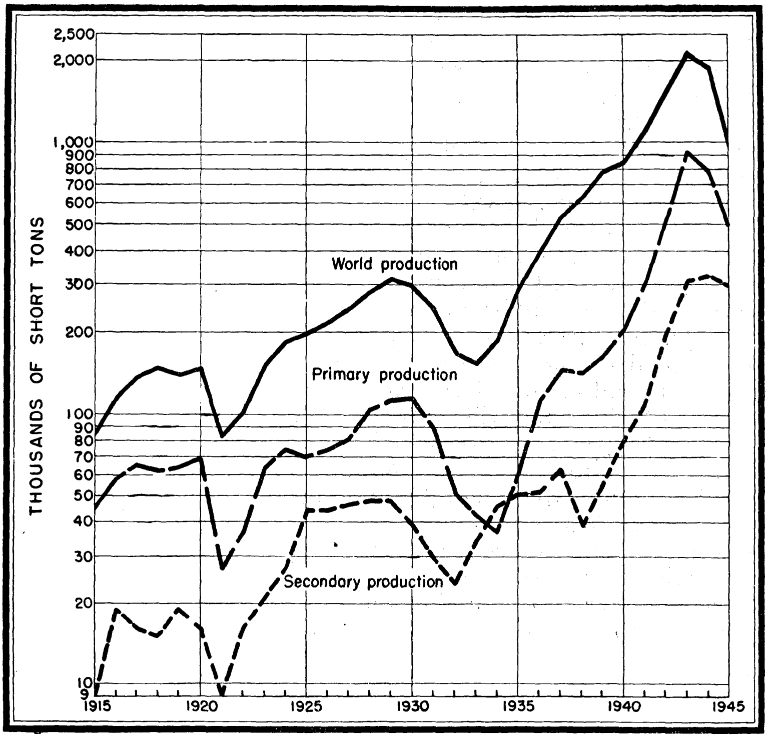

FIGURE 1.—Trends in domestic primary and secondary production and world production of aluminum, 1915–45.

pounds. Production in the form of secondary ingots totaled 198,426 tons (214,879 tons in 1944). The secondary aluminum recovered in 1945 required the consumption of 323,676 tons of aluminum scrap, of which 32,031 tons (10 percent) were old scrap (25,223 tons or 7 percent in 1944) and 291,645 tons (90 percent) were new scrap (328,959 tons or 93 percent in 1944). Remelters, smelters, and refiners used 64 percent of this scrap; aluminum rolling mills, 35 percent; and foundries and other manufacturers, 1 percent. Additional information on secondary aluminum is given in the chapter of this volume on Secondary Metals—Nonferrous.

CONSUMPTION AND USE

No statistics are gathered on the consumption of aluminum, and therefore no accurate figure for domestic aluminum consumption is available. Apparent consumption of primary aluminum, figured by adding imports to domestic production less exports and adding producers' stock increases, totaled an estimated 796,081 tons in 1945, or 7 percent more than 1944. This figure is somewhat inflated, however, inasmuch as Government stocks in the United States increased greatly during the year owing to heavy imports from Canada. Probably proportionately less metal was used for aircraft and military purposes and more for civilian purposes than in 1944, but no percentage data are obtainable.

As a result of the tremendous wartime expansion of primary aluminum-producing capacity, more aluminum is available to consumers than ever before. Expansions in fabricating facilities assure that sheet, rod, bar, forging, extrusion, and casting capacity is ample to process the primary and secondary metal available. According to the results of a survey conducted by one of the basic producers, aluminum has expanded and diversified its markets until there are now 3,500 uses for the metal compared with 1,500 before the war.[2]

According to the Annual Report for 1945 of the Aluminum Co. of America, the future for aluminum markets, both new and old, is promising. Among the new markets, perhaps aluminum roofing sheet has the greatest possibility for immediate large expansion; it is reported that major producers have a large volume of orders on hand for this material, and the potential market runs into hundreds of millions of pounds. In railroading, 1,100 passenger cars were ordered during the past year, of which 100 will be of all-aluminum construction (averaging 20,000 pounds per car), and the balance will use 2,000 to 10,000 pounds per car. A number of aluminum-hopper cars were built in 1945 for railroad use, and experimental aluminum refrigerator cars were under construction. More aluminum is being used in truck and trailer bodies and buses where the advantages of lower operating cost, lower maintenance cost, and increased pay load make aluminum a preferred material in many instances. More general use of the metal is reported in light civilian pleasure aircraft.

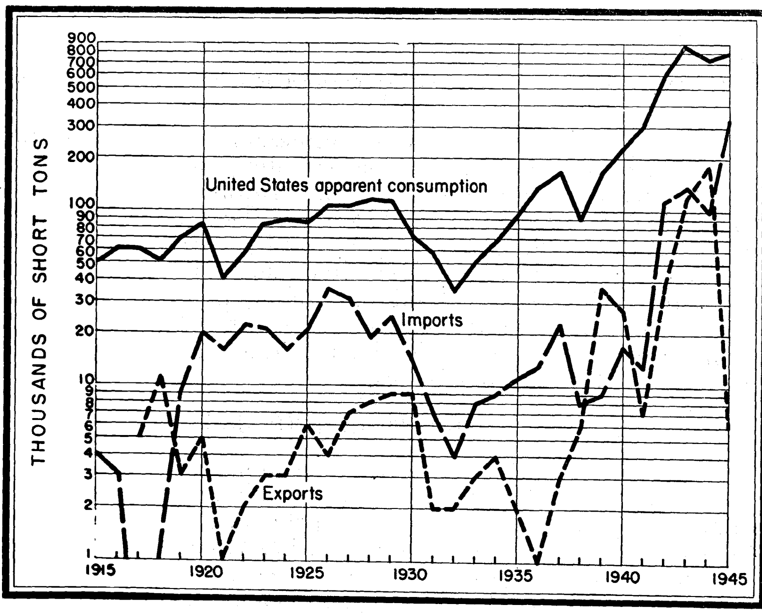

FIGURE 2.—Trends in imports, exports, and apparent consumption of aluminum, 1915–45.

[2] Schooley, Daisy L., Peace Demands for Aluminum Expand: Domestic Commerce, April 1946, pp. 27–30.

Marine construction companies are using additional quantities of aluminum on ships, particularly in superstructures. One instance was reported in which two complete aluminum upper decks are being build for cargo-passenger ships. Aluminum is being widely used in construction of new davits and lifeboats; large-scale production of aluminum canoes and other small pleasure craft was begun in 1945. Other fields in which aluminum is finding new and increased applications are building—roofing, sheathing, rain gutters and spouts, window frames, venetian blinds, screen cloth, and garage doors—refrigeration equipment, ladders, furniture, cooking utensils, tablewares, and appliances, industrial chemical equipment, textile machinery, bearings, license plates, foil wrappings, and deisel engine construction.

Production, imports, exports, and apparent consumption of primary aluminum and production of secondary aluminum in the United States, 1941–45

Year	Primary aluminum					Secondary aluminum	
	Production		Imports (short tons)	Exports (short tons)	Apparent consumption [1] (short tons)	Short tons	Value [2]
	Short tons	Value					
1941	309,067	$100,395,000	13,358	7,405	302,788	106,857	$34,707,153
1942	521,106	151,371,000	112,112	38,747	588,969	196,464	57,446,074
1943	920,179	265,380,000	135,581	117,624	877,349	313,961	90,546,352
1944	776,446	222,416,000	100,969	188,108	744,627	[3] 325,645	[3] 93,264,728
1945	[4] 496,487	[4] 141,924,000	334,125	5,741	[4] 796,081	298,387	85,297,005

[1] Data not available on fluctuations in consumers' stocks. Withdrawals from producers' stock totaled 55,320 tons in 1944; additions to producers' stocks totaled 12,232 tons in 1941, 5,502 in 1942, 60,787 in 1943, and 28,790 in 1945.
[2] Based upon average price of primary aluminum as reported to Bureau of Mines.
[3] Corrected figure.
[4] Partly estimated.

PRICES

During 1945, as in the preceding 3 years, the New York open-market base price of primary aluminum remained at 15 cents a pound for lots of 10,000 pounds or more, 99-percent-plus virgin ingot aluminum, delivered. Pig aluminum remained at 14 cents a pound, delivered, for 99-percent-plus virgin pigs during 1945. On August 30, 1945, the Office of Price Administration announced that price controls over primary aluminum ingot and pig were suspended. Controls over most aluminum castings were also suspended but sheet, rod, tubing, and other fabricated products as well as scrap and secondary aluminum were kept under price regulations.

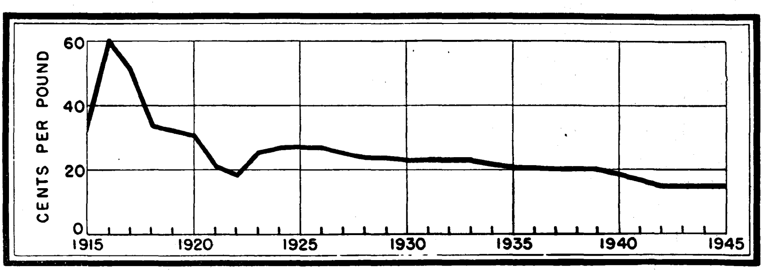

FIGURE 3.—Trend in average quoted price of aluminum, 1915–45. Price is for No. 1 virgin 98–99 percent at New York through 1929, thereafter for 99-percent-plus virgin ingot, as reported by American Metal Market.

FOREIGN TRADE [3]

Imports of crude and semicrude aluminum in 1945 reached an all-time high mark of 339,293 short tons, approximately 3⅓ times the 1944 imports and nearly 2½ times the previous record attained in 1943. The value of the 1945 imports, $98,289,843, likewise set a new record and was more than three times the 1944 value. The tremendously increased imports are attributed to the fact that the wartime virgin-aluminum contracts between the United States and Canada were completed by dint of heavy deliveries in 1945. All of the imports of crude metal, scrap, and plates, sheets, and bars were from Canada, except for 589 tons of plates, sheets, and bars shipped from the United Kingdom. Imports of aluminum (crude metal and alloys only) constituted 42 percent of the apparent consumption of primary aluminum during 1945. Manufactured aluminum articles imported rose considerably in value over 1944 and were the highest since 1942.

Aluminum imported for consumption in the United States, 1943–45, by classes

Class	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Metal and alloys, crude	135, 505	$41, 170, 788	100, 315	$29, 736, 189	332, 437	$96, 931, 816
Scrap	241	30, 364	1, 784	145, 053	5, 168	511, 824
Plates, sheets, bars, etc	76	102, 117	654	348, 740	1, 688	846, 203
	135, 822	41, 303, 269	102, 753	30, 229, 982	339, 293	98, 289, 843
Manufactures:						
Bronze powder and powdered foil	(1)	73	20	16, 887	1, 884	747, 905
Foil less than 0.006 inch thick	(1)	36	31	35, 716	100	91, 527
Table, kitchen, hospital utensils, etc	4	7, 253	1	2, 631	6	13, 906
Other manufactures	(2)	506, 413	(2)	37, 437	(2)	205, 486
	(2)	513, 775	(2)	92, 671	(2)	1, 058, 824
Grand total	(2)	41, 817, 044	(2)	30, 322, 653	(2)	99, 348, 667

[1] Less than 1 ton. [2] Quantity not recorded.

Exports of crude and semicrude aluminum during 1945 dropped to 6,543 tons from the previous year's peak of 188,521 tons. The exports were lower than in any year since 1938 and represented only 3 percent of the 1944 total. Virtual cessation of Lend-Lease shipments of primary aluminum to Russia during 1945 caused the precipitous drop in exports as compared with the previous several years. Of the 1945 exports of ingots, slabs, and crude metal (2,209 tons), 520 tons went to Brazil, 476 to U. S. S. R., 261 to Mexico, 178 to Canada, 144 to Chile, 133 to Argentina, 122 to Cuba, 117 to Uruguay, 90 to Sweden, and less than 50 tons each to Venezuela, Colombia, China, Peru, Spain, Syria, Turkey, Newfoundland, Canal Zone, Union of South Africa, Surinam, Ceylon, and Bolivia. Of 802 tons of scrap aluminum exported, 353 tons went to Canada, 252 tons to Mexico, 140 tons to Brazil, 56 tons to Cuba and less than one ton each to Venezuela and Bermuda. Of 3,532 tons of plates, sheets, bars, etc., 1,375 tons went to U. S. S. R., 935 to Canada, 480 to Brazil, 163 to Colombia, 163 to Mexico, and less than 100 tons each to 44 other countries.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Aluminum exported from the United States, 1943–45, by classes

Class	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Crude and semicrude:						
Ingots, slabs, and crude	56,741	$19,111,522	133,089	$39,027,310	2,209	$617,588
Scrap	14	3,216	413	54,466	802	102,657
Plates, sheets, bars, etc	60,883	39,977,928	55,019	34,496,958	3,532	2,343,995
	117,638	59,092,666	188,521	73,578,734	6,543	3,064,240
Manufactures:						
Tubes, moldings, or other shapes	4,131	4,593,439	5,224	7,999,206	815	640,352
Table, kitchen, and hospital utensils	32	54,342	25	40,383	177	313,225
Foil	576	474,605	1,634	1,411,531	1,306	1,512,419
Powders and pastes (aluminum and aluminum bronze) (aluminum content)	2,794	1,402,940	12,443	5,489,895	4,214	2,065,398
Other manufactures	(1)	1,598,840	(1)	1,276,590	(1)	2,270,672
	(1)	8,124,166	(1)	16,217,605	(1)	6,802,066
Grand total	(1)	67,216,832	(1)	89,796,339	(1)	9,866,306

1 Quantity not recorded.

TECHNOLOGIC DEVELOPMENTS

A revolutionary method for recovering aluminum from aircraft scrap was tested at East St. Louis, Ill., by the Aluminum Ore Co. in conjunction with the Army Air Forces during June and July of 1945.[4] The test was conducted on 500,000 pounds of wrecked aircraft scrap, and the aluminum was recovered by a process involving its reaction with a dilute caustic soda liquor in an open outdoor tank. Steel, copper, magnesium, lead, and nonmetallic materials found in the scrap were little affected by the solution and were removed from the tank after the aluminum had been dissolved. The aluminum reacted with the caustic soda solution to form sodium aluminate and the resulting solution was pumped into the Bayer process alumina plant where it lost its identity by being mixed with other alumina in process from treatment of bauxite. This scrap-recovery process is thus analogous to the recovery of aluminum from bauxite. The conclusion drawn from the results of the experiment was that the method was workable but that further tests should be made to determine its economic feasibility.

The Aluminum Co. of America, in its Annual Report for 1945, stated that numerous advances in aluminum technology had been effected through research during 1945 and included the following: A practical method for employing aluminum alloys in protection—by electrochemical action—of underground pipelines, and the interiors of steel tanks, against rusting; development of a new cast-aluminum bearing alloy; development of a new wrought and two new casting alloys, which can be made from low-cost alloyed aluminum resulting from the scrapping of war equipment; and various improvements in the manufacture of aluminum sand and permanent mold castings.

Alloy 63S, designed particularly for architecture and building applications and noted for its ability to take a bright anodic coating,

4 Aluminum Ore Co., East St. Louis, Ill. Preliminary report, Aug. 3, 1945.

was introduced during 1945, a year that also saw the commercial introduction of Alclad 14S sheet. Significant progress was made in 1945 in the fields of welding, brazing, and resin bonding. Further perfection of the Alumilite process has been reported, and peacetime customers will find the metal available in virtually every color.

GOVERNMENT REGULATIONS

War Production Board Supplementary Limitation Order M-1-k controlling aluminum was revoked on July 24, 1945, and finally virtually all controls over primary aluminum were removed on September 30, 1945, by elimination of the Controlled Materials Plan. Cancellation of military ratings and allotments had been announced on August 18 but general controls were not revoked until the Controlled Materials Plan ceased to function. On September 30, 1945, amendments to Priorities Regulations 28 and 29 represented the only controls still in effect over aluminum. The cancellation of all priority ratings except the special "top priority AAA", and the military "MM" was affected by the amendment. A civilian "CC" preference rating was introduced to be used sparingly to hasten reconversion and insure continued production and services.

WORLD PRODUCTION

Although very few reliable data are available to give a measure of the world output of primary aluminum in 1945, it can be safely stated that output was not much more than half the 1944 production. The greatest decline in output was in Germany and the central and southeastern European countries, where facilities were overrun and captured during the first 4 months of the year. There is reason to believe that many of the plants in existence in those countries were dismantled and moved as war reparations, and those that were not moved were either destroyed or ordered closed by the Allied Military Government. In the Pacific area—Japan, Formosa, Korea, and Manchuria—production, which was slowed greatly by transport difficulties and shortages of essential materials before the end of hostilities, was probably almost entirely stopped after the middle of August.

A great shift in the balance of the world capacities and world production has taken place. Germany, which ranked first among the nations of the world in capacity before World War II, is no longer a factor in the industry and will be required to import the limited quantity of metal allowed it. Japanese aluminum facilities probably will be permitted to operate at a very limited rate. New aluminum industries are developing in countries which formerly imported all their requirements—India, Brazil, China, and possibly others. Despite Russian secrecy there is some evidence which indicates that Russia is greatly expanding its capacity to produce the metal by building new plants and by relocating plants formerly situated in eastern Europe and possibly Manchuria.

In recognition of the vastly changed conditions in the world aluminum industry, the Alliance Aluminium Cie., A. G., of Basle, Switzerland, the world aluminum cartel, ceased to function in 1945.

World production of aluminum, 1940–45, by countries, in metric tons

	1940	1941	1942	1943	1944	1945
Brazil						(2)
Canada	[1] 99,014	[1] 194,023	[1] 308,984	449,737	419,179	195,691
China					64	(2)
France	61,740	63,915	[1] 45,230	[1] 46,460	[1] 26,150	37,225
Germany	204,594	223,712	254,257	242,024	236,100	(2)
Austria	6,675	9,911	9,680	8,039	(2)	(2)
Hungary	1,800	3,600	4,800	7,000	11,500	(2)
India			[3] 500	[3] 1,300	[3] 1,600	[3] 1,500
Italy	38,790	48,195	43,541	[3] 35,000	(2)	(2)
Japan	26,455	50,406	75,363	108,010	109,525	(2)
Formosa	7,638	12,272	13,209	15,387	11,262	(2)
Korea	1,155	2,814	3,872	9,444	15,999	(2)
Norway	27,780	17,528	20,498	23,514	20,035	(2)
Spain	1,295	1,120	742	797	206	(2)
Sweden	2,276	[3] 2,500	[3] 2,000	[3] 3,600	[3] 2,500	(2)
Switzerland	28,000	24,200	24,000	[3] 20,000	[3] 15,000	(2)
U. S. S. R.	59,940	[3] 50,000	[3] 55,000	62,340	[3] 71,000	86,310
United Kingdom	19,300	23,370	47,750	56,890	36,038	32,408
United States	187,100	280,383	472,737	834,768	704,376	450,403
Yugoslavia	2,000	2,000	2,000	2,000	1,000	(2)
	775,552	1,009,949	1,384,163	1,926,310	1,701,534	916,000

[1] Revised.
[2] No data available; estimate included in total.
[3] Estimated production. Estimates by the authors.

REVIEW BY COUNTRIES

Brazil.—On March 29, 1945, the first primary aluminum to be made in South America was poured at the Saramenha plant of Electro-Chimica Brasileira in the State of Minas Gerais. This, the first of three projected plants in Brazil to go into production, is rated at 2,500 metric tons annual capacity. The plant of Companhia Brasileira de Aluminio, S. A., at Rodovalho in São Paulo is reported to be partly constructed; but the third plant at Campos, to be built by Companhia Industrial Brasil-Aluminio, is said to be still in the planning stage. A number of factors are favorable to the establishment of an aluminum industry in Brazil, among them being large deposits of high-grade bauxite, a high hydro-power potential, abundant and cheap labor, a domestic market with possibilities for great expansion, and the favorable attitude of the Brazilian Government toward establishment of new industrial enterprises and toward their protection from foreign competition. As an indication of the present domestic market for aluminum in Brazil, more than 3,000 tons of primary metal were imported in the first 9 months of 1945.

Canada.—The Aluminum Co. of Canada, Ltd., reported that in the five war years, 1940 to 1944, inclusive, 55 percent of its production was sold to the United Kingdom; sales to the United States were 32 percent of the total; Russia took 4.3 percent; Australia, 1.2 percent; and other United Nations countries, 1.5 percent. Only 6 percent of total production of aluminum during these years was consumed in Canada. According to H. H. Richardson, vice president of Aluminium Laboratories, Ltd., increasing civilian outlets for the metal should enable Canada to maintain production exceeding 200,000 short tons a year, or 40 percent of total rated wartime capacity. Canada is now in a position to manufacture extruded shapes and castings and to roll sheet in much larger sizes than before the war. A large outlet is expected in aluminum roofing sheet and in aluminum houses being built to relieve the domestic housing shortage.

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On May 17, 1945, Aluminium, Ltd., called for the dissolution of the Alliance Aluminium Cie., A. G., in Switzerland (the international aluminum cartel) and formally denounced the agreements between itself and the European shareholders in the company.

China.—According to articles in the American press, China plans a gigantic development program and estimates that 100,000 tons of aluminum capacity will be in operation by the tenth year of the plan. The Sixth Kuomintang Congress resolved that China should establish a large aluminum industry to provide raw material for its aircraft program and as a partial substitute for copper. At the request of the Chinese Government, the Bureau of Reclamation, United States Department of the Interior, is said to be working out a basinwide development program in the Yangtze River Valley. Plans call for construction of a large dam and hydroelectric plant.

France.—Reliable reports from France state that imports, exports, and consumption of primary aluminum were as follows, in metric tons, from 1939 to 1944:

	1939	1940	1941	1942	1943	1944
Imports	2, 332	19, 109	3, 689	1, 691	968	766
Exports	13, 052	9, 095	28, 383	10, 272	15, 890	1, 830
Consumption	41, 780	71, 754	39, 221	36, 649	31, 538	25, 086

Germany.—The production of primary aluminum has been banned in Germany, and imports into that country will be limited to 30,000 tons of metal a year, or about one-tenth of the annual consumption rate from 1940 to 1944, inclusive. Until further reports are available, it is not possible to estimate the 1945 output of aluminum in Germany, but it certainly was less than half of that produced in 1944.

Hungary.—According to reports received since the collapse of Germany, the German plans for a great expansion of the Hungarian alumina industry were not completed before the surrender. The 60,000-ton plant being constructed by the Dunavoelgye Timfoeldgyar, a company formed in 1941 by joint participation of the Bauxite Trust and the German and Hungarian Governments, was nearly completed in 1945. However, sensing that the Danube Valley area would be overrun by the Russian army, the Germans removed much of the equipment from the plant and abandoned it. It is reported that additional equipment was appropriated by the Russians as war booty and that Russia will obtain the remaining processing facilities as reparations. If no further processing capacity is removed from Hungary as reparations, the country will have two alumina plants with a capacity of 26,000 metric tons a year. The two plants are the 14,000-ton-a-year works at Magyarovar owned by a subsidiary of the Bauxite Trust and the 12,000-ton-a-year works at Ajka owned by the Magyar Bauxitbanya, R. T.

Three aluminum-reduction plants in Hungary have a total capacity of 18,800 metric tons annually, approximately 5,800 tons in excess of the quantity that can be produced from domestic alumina. At Ajka a 10,000-ton plant owned by Magyar Bauxitbanya, R. T., was completed in 1943 and used coal from the Ajka Coal Mines, Inc., as its source of electric power. The company rolling mill at Szekesfehervar formerly processed the aluminum metal produced at Ajka, but the mills have been dismantled by the Russians. It is reported that, in spite of the loss of machinery taken for reparations by Russia, the company would be able to operate on a limited scale if equipment removed by the Germans was returned. The Felsoegalla plant of Hungarian General Coal Mines, Inc., which began operations in 1940, has a capacity of 4,800 tons annually and is reported to be intact. The third plant at Csepel, owned by the Manfred Weiss concern, which began production in 1935, incurred serious damage during the latter part of the war, reducing its 4,000-ton capacity by some 30 percent.

India.—According to official statements, the present capacity of the aluminum industry in India is 7,000 tons annually, and it is anticipated that, with favorable conditions, production will be increased to 20,000 tons within 10 years. Late in 1945 output of the Aluminium Co. of India, Ltd., was stated to be about 100 tons of metal a month, and the company expects to begin using Indian bauxite as a raw material as soon as its alumina plant, under construction at Lohardaga, Bihar, is completed. The other producing company in India, Aluminium Corporation of India, Ltd., located in the Asansol area of Bengal, is said to have a daily capacity of 13.5 tons of aluminum ingot and 40 tons of alumina. Production presumably began at Asansol during 1945.

Italy.—A report of the British Intelligence Objectives Subcommittee on aluminum-reduction plants in Italy states that production at the 3,000-ton plant of the Societé dell 'Alluminio Italiano at Borgofranco declined steadily from the high point reached in 1941, owing to power and raw material shortages, and that the plant was finally closed in December 1944 following exhaustion of alumina supplies. The plant is said to have incurred little or no war damage. Output from the Porto Marghera works, which includes a 75,000-ton alumina plant and a 20,000-ton aluminum-reduction unit owned by the Swiss-controlled Societé Alluminio Veneto Anonima, was stopped in June 1944 owing to a lack of raw materials, but production was resumed on a limited scale at the reduction plant in October 1945. The reduction plant was considerably damaged by bombing during 1943 and is incapable of capacity operations at present. Industria Nazionale Alluminio owns two plants in the Adige Valley, a 16,000-ton plant at Bolzano and a 14,000-ton plant at Mori. The Mori plant was shut down entirely, and the Bolzano plant was cut to a low rate of output when the Porto Marghera alumina works ceased operations. Permission was obtained late in 1945 from the Allied Commission to operate the Bolzano plant at 12 tons a day and the Mori plant at 5 tons a day. The plants escaped bomb damage during the war, although the town of Bolzano itself was heavily damaged.

Japan.—Military Government reports from Yokohama late in 1945 indicate that, at the end of war, Japan had a total Bayer-process alumina capacity of 307,000 metric tons annually in the home islands and in addition had 47,500 tons annual capacity for making alumina from clay, shale, and alunite. Plants in Formosa, Korea, and Manchuria actually completed by the end of the war were capable of producing about 87,000 tons annually from bauxite and aluminum shales. Rated capacity of aluminum-reduction plants in the home islands was 134,200 tons annually and in the occupied territories

68,000 tons. Incomplete reports of Japanese army and navy inventories indicated that about 150,000 metric tons of aluminum and aluminum alloys were on hand at the end of the war. According to Military Government authorities, this quantity would make Japan self-sufficient in light alloys for permitted uses for 8 to 10 years. Stocks of bauxite and alumina in Japan are thought to have been very low late in the year, but enough was on hand to allow the Nippon Light Metals Co. to begin production of aluminum on November 25. This was the first output since the surrender. During December 1945, 641 metric tons of sheet and wire were produced in 22 rolling mills in Japan from aluminum and aluminum alloy.

Mexico.—Reynolds Metals Co. announced in May 1945 that it had established an aluminum-fabricating company in Mexico in cooperation with the Banco Nacionale de Mexico. The new company, known as Reynolds Internacionale de Mexico, will produce aluminum sheet, plate, and foil and plans later to enter other fields of fabrication, such as forgings, extrusions, rod, bar, cable, powder, and paste.

Norway.—According to military intelligence reports, early in 1945 Germany gave up its program for producing aluminum in Norway and began to evacuate or destroy equipments from plants it had built or was building. As a result, the Norwegian plants (which had operated on imported raw materials prior to the German occupation) were forced to curtail output even further, owing to lack of supplies. Reports in late August were that Norwegian aluminum output was at an all-time low, with the Norsk Aluminium Co. operating at 50 percent of capacity. Demand for the metal far exceeded supply, owing to deferred repairs, construction requirements, and substitution of aluminum for other metals such as tin.

When adequate supplies again become available, however, it is likely that Norway will find itself with more aluminum-reduction capacity than can be used, since the normal domestic market took only a small part of total sales before the war. Most of the prewar metal was exported (28,600 metric tons in 1938), but increased competition from enlarged wartime facilities abroad may force the price lower than that at which Norway can compete in the world market.

Sweden.—Much pessimistic comment concerning the future position of the Swedish aluminum industry appeared in various trade journals during 1945, even though domestic capacity represents little over 50 percent of estimated demand. The main difficulty is the high cost of production, said to almost double the American and Canadian selling prices for the metal. In November an attempt was made to limit imports by requiring a Government license, but this was later removed, along with price control on aluminum ware. This latter action followed reports that subsidy or "equalization" payments to producers were discontinued and may force closing of Swedish aluminum reduction works.

Switzerland.—Owing to a lack of domestic aluminum raw materials and to the fact that alumina is not made in any plants in Switzerland, the Swiss aluminum industry was faced by grave problems in attempting to maintain output during the war years. According to the annual report of Aluminium-Industrie, A. G., imports of alumina were sufficient to allow operations at a moderately high rate during the early years of the war. Because of the general scarcity of alumina on the continent, however, supplies were exported to Switzerland from France and Italy on a quota basis and under conditions requiring that a portion of the metal produced should be reexported.

Before the summer of 1943, about two-thirds of Switzerland's alumina imports had come from Porto Marghera, Italy, and during that summer imports were interrupted owing to transportation difficulties. In the following summer, imports from France stopped entirely until the spring of 1945. Steps were taken in 1943, despite the then large stocks of alumina, to cut down metal production at Chippis; further cuts were necessitated in 1944, so that only one-third of the plant capacity was in use most of the year. By the last few months of 1944, output was at 20 percent of capacity, and finally at the end of January 1945 the aluminum-reduction works was closed. Stocks of aluminum metal and manufactured products were at a very low level in early 1945. After many attempts at reestablishing imports of alumina, a shipment of 600 tons was received during April 1945, and it was hoped that aluminum production would begin shortly thereafter as further imports were received. No data are available on the Swiss industry during the last half of 1945, but it is probable that production was resumed, although not at a rate approaching capacity.

Union of South Africa.—Aluminium, Ltd., of Canada announced that it has formed a subsidiary to be known as Aluminium Co. of South Africa (Pty.), Ltd., which would produce foil and sheet at Pietermaritzburg.

United Kingdom.—Data released by the Light Metals Control in the Monthly Digest of Statistics revealed that consumption of virgin aluminum was approximately 100,000 long tons in 1945, compared with a peak of 207,600 tons in 1943. In the 6 years from 1940 to 1945, inclusive, production of virgin aluminum was just over 210,000 tons and imports about 730,000 tons. Total supply during this period was thus 940,000 tons, compared with recorded consumption of about 870,000 tons in the same period, indicating that stocks of metal on hand were some 70,000 tons greater than at the beginning of 1940, when they were at a very low level. In 1945 the percentage of secondary aluminum in the total United Kingdom consumption was 39.5 percent. Secondary ingot production for 1945 was 61,912 tons, compared with virgin production of 31,896 tons.

U. S. S. R.—A new Russian aluminum-reduction plant was reported to have begun operation in the middle of 1945 at Bogoslovsk, west of Serov, where it is said a giant aluminum-producing center is partly built. Three hydroelectric stations being built or enlarged on the Kola Peninsula are expected to speed expansion of rebuilt and new plants in the Kandalaksha area. Reconstruction of the great Dniepr dam and power station in the Ukraine is understood to be progressing and may allow resumption of aluminum output at the Zaporozhe reduction works. Russia claimed in 1945 that it was second to the United States in aluminum production, although it seems unlikely that facilities in the U. S. S. R. are equal in capacity to those in Canada.

MERCURY

By Helena M. Meyer and Alethea W. Mitchell

SUMMARY OUTLINE

SUMMARY

Despite the ending of hostilities in Germany in May and the collapse of resistance in Japan in August, the promise that war demand for the new dry battery would cause mercury consumption to reach new record levels in 1945 was fulfilled in generous measure, and the consumption of 63,900 flasks exceeded the previous record in 1943 by 17 percent. The quantity of mercury used, nonetheless, fell far short of expectations had 1945 proved a full war year. Consumption was on the uptrend at the beginning of 1945 and continued upward through May, when a new high monthly record rate of 8,900 flasks was established. Total consumption dropped in June, but the quantities used for batteries reached a peak in that month. War contracts for the new-type battery were canceled following termination of hostilities with Japan; consumption fell to 5,300 in August and to only 2,000 flasks in December, when it was at the lowest rate for nearly 6 years.

Another record was broken by a wide margin in 1945—that for imports. The anticipated enormous expansion in consumption of mercury at the outset of 1945 caused manufacturers to look to Spain for large, rapidly increased supplies of metal to augment production from domestic mines. Metal from stocks on hand in Spain began to enter the country in large quantity in April; general imports of 10,963 flasks in April marked a new high monthly record, which was almost doubled by the entry of 19,504 flasks in July. In November imports totaled 18,261 flasks, a quantity second only to that for July. Imports in July and November resembled prewar annual totals more closely than monthly ones. Recorded imports totaled 71,508 flasks in 1945, or 49 percent more than the previous annual peak entries in 1943.

Production at domestic mines declined in 1944 following cancellation of Government-purchase contracts and the sharp reduction in prices that accompanied the belief, widely held at the time, that all requirements were amply provided for. The price rise that resulted from the placing of battery contracts probably followed the disappointments of other sharp price movements too closely to tempt domestic operators to reopen mines or to expand output at already active mines without some assurance that the higher prices would continue. Production of 1,200 flasks in October 1945 was less than the average monthly rate for any year since 1933. The monthly average for the final quarter of 1945 was nearly 10 percent below the average monthly rate that prevailed in the prewar years 1938–39.

Salient statistics of the mercury industry in the United States, 1941–45

[Flasks of 76 pounds]

	1941	1942	1943	1944	1945
Production flasks	44,921	50,846	51,929	37,688	30,763
Number of producing mines	197	184	146	102	68
Average price per flask:					
New York	$185.02	$196.35	$195.21	$118.36	$134.89
London	$194.20	$227.87	$281.44	$281.44	$242.45
Imports for consumption:					
Pounds	588,228	[1] 2,959,489	[1] 3,633,216	1,486,025	5,214,890
Equivalent flasks	7,740	[1] 38,941	[1] 47,805	19,553	68,617
Exports:					
Pounds	196,837	[1] 26,252	[1] 29,236	57,007	78,852
Equivalent flasks	2,590	[1] 345	[1] 385	750	1,038
Consumption flasks	44,800	49,700	54,500	42,900	63,900

[1] Large quantities were reexported in 1942 and 1943.

The price began to rise in the latter part of 1944 under the influence of the battery program. In July of that year the average quoted price for mercury at New York was less than $101 a flask. The top of the upswing was reached in February 1945 when the monthly quotation was $166 a flask. Doubtless the availability of large stocks of metal in Spain and the actual receipt therefrom of supplies ample for the battery program caused a collapse in quotations, which reached a low point of $96 a flask in September. After the end of the Japanese phase of the war, fears were held that the market would have to absorb unprecedented quantities of metal released by Government contract cancelations. The removal of such surplus stocks from the market for the permanent Government stock pile resulted in an upward reaction in prices in the final quarter of 1945; the average for December was 13 percent above that for September, when the lowest monthly average for the year was established. During 1944–45, while the prices of other commodities controlled by Office of Price Administration ceilings remained constant at the ceiling levels, the price of mercury was unique in that it fluctuated widely. Mercury ceiling-price restrictions were suspended late in August 1945.

Undoubtedly industry stocks rose to unprecedented levels in 1945, although long-time records on inventories have not been maintained. From the time the Bureau of Mines began to compile monthly data in September 1939 to the end of 1944 consumers' and dealers' stocks ranged between 7,400 and 15,300 flasks. At the end of October 1945, following battery contract terminations and before the Government began to absorb surplus metal into the permanent stock pile, consumers and dealers held 37,800 flasks. Industry stocks fell to 17,000 flasks by the end of the year, and a large part of this total was scheduled for the stock pile.

Thus, supply conditions in the mercury industry in the United States were reversed again in 1945, as had already happened twice since World War II started. To take care of emergency war needs for the metal, the Government released mercury from stocks of the Office of Metals Reserve at the beginning of the year. By the third quarter conditions had changed so that it became desirable for the Government to acquire ownership of mercury released from contract cancelations for the permanent stock pile. This latter action had the effect of preventing complete disruption of the domestic market.

Figure 1 shows trends in production, consumption, and price of mercury from 1910 to 1945.

Conditions in foreign countries.—Italy and Spain each produced about 40,000 flasks of mercury in 1945, or less than half of the capacity of either country. Italian production has advanced following the

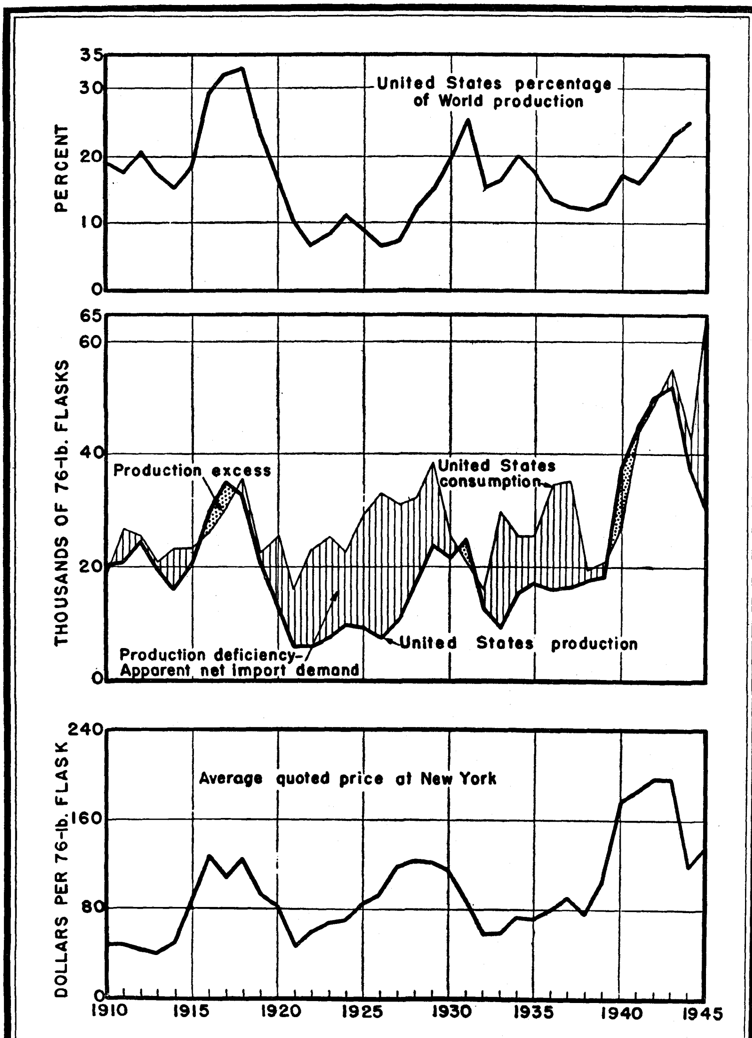

FIGURE 1.—Trends in production, consumption, and price of mercury in the United States, 1910–45.

operating difficulties experienced after the Germans retreated (described in the report of this series for 1944 under Italy) and those that coincided with the carrying on of operations under an army of occupation. Spanish output was low in 1945 because large stocks were on hand at the beginning of the year and because world demand was expected to shrink considerably in the postwar years. Canadian mines remained idle in 1945 in the absence of sufficient incentive to cause their reopening. Production in Mexico was reduced because of the canceling of contracts with the United States Government in 1944 and because the price for mercury was inadequate for numerous operations.

Mercury cartel.—The mercury cartel, Mercurio Europeo, was being revived at the end of 1945. The Spanish mine at Almaden and two Italian producers, Società Anonima Mineraria Monte Amiata and Stabilimento Minerario del Siele, are reported to have formed a selling organization to handle all export sales of mercury, with offices at Madrid (Alcala 47) and Rome (Via Regina Elena 47). The firm advertised internationally its desire to hire representatives in the United States and Europe. The policy of the United States Government toward cartels is such that the appointment of a cartel sales agent in the United States at least for other than export sales was expected to involve difficulties.

Future prospects for world consumption.—There seems to be no prospect that postwar world consumption of mercury will soon approach the quantities used in the war period, and it is unlikely too that postwar use of the metal will even equal the quantities absorbed in the immediate prewar years. Germany vied with the United States as the largest mercury-consuming nation in the world before World War II, and Japan ranked among the first four countries in this regard. Germany's increased consumption[1] went largely into new or expanded plants where mercury was used as a catalyst or in the electrolytic production of chlorine and caustic soda, and in such plants the mercury is available for recovery for subsequent use if the plants are dismantled in whole or in part. In addition, a quantity of metal (see section on Germany) adequate for, roughly, 2 years' consumption at prewar levels was held in stock in Germany at the end of the war. Thus, not only will it be unnecessary to import mercury into Germany for some time to come, but metal in use there during the war may fill part of the postwar requirements of other nations. Japan is in a similar position, although smaller quantities of mercury are involved in that country. The prospects for increased consumption in the United States appear to be related closely to the postwar development of the new dry-cell battery, although certain other new uses are said also to promise greater use of mercury. The company that controls the patents for the battery's manufacture is restrained in predicting the size of postwar consumption.[2] It is also possible that prospective increases in mercury consumption in the manufacture of batteries may be offset, in part, at least, by declines in consumption for other purposes. On the whole, however, it appears that in the United States, mercury probably will be consumed in the future at

[1] Minerals Yearbook, 1943, p. 729.
[2] Bradley, Worthen, Mercury Meanderings—pt. II: Min. Cong. Jour., vol. 32, No. 3, March 1946, pp. 35–38.

not less than prewar levels, with prospects for a rise to considerably higher rates at least a possibility. Undoubtedly consumption in the United Kingdom will follow the use pattern in the United States, even to production of the new batteries, and the United Kingdom likewise should require as much mercury as before World War II.

Geological Survey[3] *and Bureau of Mines activities.*—After hostilities ceased in 1945, Geological Survey work on quicksilver was aimed at increasing the knowledge of ore deposits as an aid in finding new ore bodies if another emergency occurred. With this in mind the New Almaden, Calif., project was enlarged to include not only Mine Hill but also a large surrounding area. Field work was still in progress at the end of 1945. At Steamboat Springs, Nev., special emphasis is being placed on a study of the origin of the springs and conditions under which deposits of mercury and antimony develop. A preliminary paper has been prepared and will be published in the near future. Two of the Survey's quicksilver reports were published during the year by the California Division of Mines.[4]

In 1945 the Geological Survey issued a report on the quicksilver-antimony deposits of Huitzuco, Guerrero, Mexico.[5] Reports on other mercury districts in Mexico are in course of publication. Field work on the study of the Huancavelica mercury district, Peru, was completed by the Geological Survey under the auspices of the State Department, and the report is being prepared for publication.

The Geological Survey continued investigations of Alaskan quicksilver deposits during 1945. New lower levels of the Red Devil mine near Sleitmut were mapped in detail. New openings at the Decoursey Mountain mine near Crooked Creek were examined. Aerial reconnaissance mapping of intervening regions was continued, and formations favorable for the occurrence of quicksilver were discovered along the upper Holokuk River.

The Bureau of Mines continued the work begun in earlier years at numerous locations.

DOMESTIC PRODUCTION

The monthly production rates for 1945 varied widely due largely to the unusual conditions that characterized the industry in that year. Consumption was pointed upward at the beginning of the year and was headed for historic peak levels later in the year; prices also were high early in 1945. Domestic producers, however, had recently experienced wide price movements and may have hesitated to expand production, pending more stable conditions. Moreover, rains and winter weather adversely affect domestic output in December and January, and in the 2 months in question labor supplies were inadequate and were thus a further deterrent to production. Production in December 1944 and in January 1945 was 2,500 flasks, or well below the average for the war period, particularly in relation to that part of the period that preceded July 1944. In July 1945, production rose to a high monthly rate for the year of 3,600 flasks, but by that time

[3] Information obtained from Juanita Crawford, Geological Survey.

[4] Yates, R. G., and Hilpert, L. S., Quicksilver Deposits of Central San Benito and Northwestern Fresno Counties, Calif.: California Jour. Mines and Geol., vol. 41, No. 1, January 1945, pp. 11–35.

Averitt, Paul, Quicksilver Deposits of the Knoxville District, Napa, Yolo, and Lake Counties, Calif.: California Jour. Mines and Geol., vol. 41, No. 2, April 1945, pp. 65–89.

[5] McAllister David and rtiz, David Hernandez, Quicksilver-Antimony Deposits of Huitzuco, Guer- [illegible] 946–B 1945, pp. 49–71.

record quantities were arriving from Spain, and the end of the war demand was in sight. The collapse of consumption and prices that coincided with the end of hostilities caused the output to sink to lower levels than before the war; in the final quarter of the year, production was only half of the reduced rate in the first quarter and averaged even less than in the period 1938–39.

Mercury produced in the United States, 1941–45, by months, in flasks of 76 pounds

Month	1941	1942	1943	1944	1945
January	3,100	3,700	4,200	4,400	2,500
February	2,900	3,400	3,900	3,800	2,700
March	3,500	4,100	4,600	3,800	3,000
April	3,500	4,200	4,600	3,700	3,000
May	3,600	4,800	4,200	3,400	3,300
June	4,000	4,900	4,100	3,000	3,000
July	3,400	4,700	4,300	2,700	3,600
August	4,100	4,500	4,500	2,500	3,300
September	4,200	4,200	4,500	2,500	2,050
October	4,000	4,100	5,200	2,700	1,200
November	3,800	4,100	5,000	2,300	1,350
December	3,900	4,400	4,200	2,500	1,600
	[1] 44,921	[1] 50,846	[1] 51,929	[1] 37,688	[1] 30,763

[1] Final annual figure; monthly totals not adjusted.

Mercury produced in the United States, 1942–45, by States

Year and State	Producing mines	Flasks of 76 pounds	Value [1]
1942:			
Arizona	7	701	$137,641
Arkansas	16	2,392	469,669
California	85	29,906	5,872,043
Nevada	40	5,201	1,021,217
Oregon	23	6,935	1,361,687
Alaska, Idaho, Texas, Utah, and Washington	13	5,711	1,121,355
	184	50,846	9,983,612
1943:			
Alaska	3	786	153,435
Arizona	3	541	105,609
Arkansas	18	1,532	299,062
California	65	33,812	6,600,440
Idaho	1	4,261	831,790
Nevada	33	4,577	893,476
Oregon	16	4,651	907,922
Texas	7	1,769	345,326
	146	51,929	10,137,060
1944:			
Arizona	3	548	$64,861
Arkansas	8	191	22,607
California	58	28,052	3,320,235
Nevada	17	2,460	291,166
Oregon	8	3,159	373,899
Texas	4	1,095	129,604
Alaska and Idaho	4	2,183	258,380
	102	37,688	4,460,752
1945:			
California	39	21,199	2,859,533
Idaho	1	627	84,576
Nevada	12	4,338	585,153
Oregon	6	2,500	337,225
Alaska, Arizona, Arkansas, and Texas	10	2,099	283,134
	68	30,763	4,149,621

[1] Value calculated at average price at New York.

There was an 18-percent drop in production for the United States as a whole, and totals for all areas except Nevada and Alaska declined more than the average; output in Nevada gained 76 percent and in Alaska 52 percent. California continued to account for an outstanding share of the total, or 69 percent in 1945 compared with 74 percent in 1944. Production in California dropped 24 percent, in Oregon 21 percent, and in Arizona, Arkansas, Idaho, and Texas even more sharply. Nevada rose to second place among the mercury-producing areas in 1945, having displaced Oregon which held second position continuously from 1936 through 1944.

The principal producing mines in 1945 were as follows:

Alaska—Red Devil and Decoursey Mountain mines.

Arizona—Gila County, Ord mine.

California—Contra Costa County, Mount Diablo mine; Lake County, Abbott, Mirabel, and Sulphur Bank mines; Napa County, Knoxville mine; San Benito County, New Idria mine; San Luis Obispo County, Buena Vista (Mahoney) mine; Santa Barbara County, Red Rock mine; Santa Clara County, Guadalupe and New Almaden mines; Sonoma County, Mount Jackson mine; Yolo County, Reed mine.

Idaho—Valley County, Hermes mine.

Nevada—Humboldt County, Cordero mine; Pershing County, Red Bird mine.

Oregon—Douglas County, Bonanza mine.

Texas—Brewster County, Chisos-Waldron mine.

In 1945 these 20 mines produced 97 percent of the United States total; in 1944, 31 mines contributed 97 percent; and in 1942, 34 mines produced 89 percent.

Of the larger mines listed in the chapter of this series for 1944, the following are missing from the foregoing list: Pine Mountain, Arizona; Helen, Oat Hill, Klau, Falcon (Santa Ynez), Culver-Baer, and Altoona, California; Red Rock and Pershing, Nevada; Horse Heaven, Oregon; and Big Bend, Texas Almaden, and Fresno mines, Texas. The only name added was the Red Rock, California. None of the principal mines in 1945 produced less than 100 flasks of mercury. Of these properties, only the following reported production in December: Mount Diablo, Abbott, Knoxville, New Idria, Red Rock, Guadalupe, Mount Jackson, Reed, Hermes, Cordero, Bonanza, and Chisos-Waldron. These 12 mines produced 98 percent of the December total.

The trend toward the treatment of higher grades of ore, as a consequence of lower prices (noted in the chapter of this series for 1944), continued in 1945. The average grade of ores treated in 1945 was 0.54 percent (10.8-pound ore) compared with 0.47 percent (9.4-pound ore) in 1944, 0.31 percent (6.28-pound ore) in 1943, and 0.25 percent (5-pound ore) in 1942. The 1945 grade was the highest reached since 1926 and equaled the record for that year. There was a continuation in 1945 of the closing of properties with only low-grade reserves.

REVIEW BY STATES

Alaska.—Alaskan production of mercury reached a new peak in 1945, rising against the trend in most areas. Operations at both the Red Devil (New Idria-Alaska) and the Decoursey Mountain properties were closed at the end of the year because of the winter season. As previously, the Red Devil ore was treated in a 3- by 40-foot Gould rotary furnace, and that at Decoursey Mountain was reduced in a two-tube D-type retort. The main shaft at the Red Devil mine was sunk 50 feet to the 100-foot level, and most of the ore treated in 1945 was from the new level.

Arizona.—Only two mercury properties produced metal in 1945—the Ord in the Brown district, Gila County, and the National in the Sunflower district, Maricopa County. The Pine Mountain mine, also in the Sunflower district, which produced in 1944 and earlier years since 1940, closed in December 1944 and remained idle throughout 1945. At the Ord mine 889 tons of ore were treated in a 20-ton Foster furnace in 1945 to recover 117 flasks of mercury. The National ore was also furnaced at one of the new plants mentioned in the report of this series for 1944.

California.—Production of mercury in California declined 24 percent from 1944, or more than the average decrease of 18 percent for the country as a whole, but this State continued, nevertheless, to produce a very substantial proportion of the United States total, that is, 69 percent in 1945 as compared with 74 percent in 1944. The largest mercury-producing mine in the Western Hemisphere was again the New Idria, San Benito County. This property produced less metal than in 1944 because of market conditions in the latter part of the year; output in the first 8 months was at approximately the peak annual rate of 1943. Among the larger producers, the following had greater outputs in 1945t han in 1944: Mount Diablo, Contra Costa County; Buena Vista, San Luis Obispo County; Red Rock, Santa Barbara County; Guadalupe, Santa Clara County; and Mount Jackson, Sonoma County. Substantial decreases or complete discontinuance of operations were reported for the Abbott, Mirabel, and Sulphur Bank mines, Lake County; Knoxville and Oat Hill mines, Napa County; New Idria mine, San Benito County; Klau mine, San Luis Obispo County; Falcon (Santa Ynez) mine, Santa Barbara County; New Almaden mine, Santa Clara County; Altoona mine, Trinity County; and Reed mine, Yolo County.

Fourteen counties contributed some production in 1945, as follows: Contra Costa, Del Norte, Fresno, Inyo, Kings, Lake, Napa, San Benito, San Luis Obispo, Santa Barbara, Santa Clara, Sonoma, Trinity, and Yolo. Mono, Monterey, and Stanislaus were among the producing counties in 1944 but Kings County was not.

The Bradley Mining Co. produced mercury again at its Mount Diablo mine in Contra Costa County. This property is equipped with a Gould rotary furnace and D-type retort.

Oscar E. Hanno produced 69 flasks of mercury from 103 tons of ore in a 2-ton inclined retort at the Patricks Creek mine, Del Norte County, in 1945. The ore was followed for 30 feet on a 45° incline, and a new adit was being driven 6 feet below the bottom of the incline to determine the course of the ore.

Joe Larios produced nine flasks of mercury in a retort at the Santa Rita mine, Fresno County. The property was reported closed for the winter.

Production of mercury was reported for the Kings and Dawson properties, Kings County, in 1945. Retorts were used at both locations.

Seven properties in Lake County produced mercury in 1945. This county was second only to San Benito as a mercury-producing area in the United States in 1944 but dropped in importance in 1945 to rank only fifth among the counties of California. Production of 1,447 flasks of mercury from 9,556 tons of ore represented only 38 percent of the 1944 output. The chief producer was again the Abbott mine, 3 miles by road southwest from Wilbur Springs; this property dropped to sixth place among mercury producers in the United States in 1945 after having risen quickly to third place in 1944. A Gould rotary furnace, with a rated capacity of 40 tons of ore a day, was in operation at the end of the year. Development at the Abbott consisted of drifting into virgin ground and prospecting in an area that had been very productive years ago. Next to the Abbott mine, the Sulphur Bank mine, operated by the Bradley Mining Co., and the Mirabel mine were the most productive in the county, rotary kilns being used at both properties. An article on the Sulphur Bank and Reed (Yolo County) plants[6] was recently published. The Mirabel mine was closed November 17, with no plans for reopening. Mercury was produced in a Gould rotary furnace by Kline and Peterson. Small outputs were also made in retorts at the Big Chief and Thorne properties by John Johnson, who turned the properties back to the owners. The Bradley Mining Co. produced a small quantity of mercury, probably from clean-up operations, at the Great Western mine.

Output of mercury in Napa County was sharply reduced in 1945; the total (287 flasks) was only 24 percent of that for 1944. The drop is explained by discontinuance of the larger operations at the Oat Hill and Knoxville mines, although there were two separate producers on each of these properties in 1945. Cerar, Carr & Truitt and Hickox & Wilson both produced at the Knoxville mine and accounted for the larger part of the total for Napa County. Output at Oat Hill was largely from clean-up activity in connection with dismantling and removing the furnace. The Eureka No. 3 Dump and three other properties produced small quantities.

The outstanding mercury producer in the United States in 1945, by a wide margin, was the New Idria mine, operated by the New Idria Quicksilver Mining Co. A total of 10,193 flasks of mercury was produced in the county in 1945. The New Idria mine, in the Idria district 70 miles south of Hollister, produced more metal than its next three competitors in the United States. Two of the four furnaces were in operation in the early part of the year, but toward the end only one was active, and even this one was idle during October and most of November. A new condensing system of somewhat new design was installed at two furnaces near the end of the year. Bradley[7] said that the New Idria had found a "magnificent ore body by an intelligently planned and executed development campaign." New Idria, he said, already had ore; but recent discoveries, stimulated by isometric plotting of the ground, had added years of life to this remarkable old mine. The Stayton mine, operated by R. B. Knox, had a small output from a retort in 1945, and Arthur Weerts reported small retorting operations at the Mitchell and Pico Rico properties.

A total of 873 flasks was produced in San Luis Obispo County. Production was dominated by operations of W. R. and F. M. Wyatt and by Virgil Smith at the Buena Vista mine. Clean-up around the plant and dumps at the Klau mine and possibly the same type of activity at the Oceanic mine yielded the remainder of the county total.

Mercury was produced in a 35-ton Gould rotary furnace at the Red

[6] Hall, R. G., and Bradley, Worthen, Concurrent Firing at the Sulphur Bank and Reed Quicksilver Plants: Am. Inst. Min. and Met. Eng., Metals Technol., vol. 12, No. 8, December 1945, 11 pp.
[7] Bradley, Worthen, Mercury Meanderings—pt. I: Min. Cong. Jour., vol. 32, No. 1, January 1946, p. 37.

Rock mine, Cachuma district, Santa Barbara County, by the National Mining &Milling Co.

The New Almaden mine, operated by the New Almaden Corp., and Guadalupe mine, operated by Laco Mining Co., Inc., led as producers of mercury in Santa Clara County in 1945. In all, 1,646 flasks were produced in the county compared with 1,699 flasks in 1944 and with the recent peak of 2,715 flasks in 1941. Large furnaces were used at each of the mines already mentioned. The New Almaden mine was recently described.[8] In addition to the foregoing the Almaden Dumps were operated by C. L. Thomas, and three other operators produced small quantities at other locations.

The Mount Jackson mine produced a very high percentage of the total output of Sonoma County in 1945, a continuation of the situation that has existed since 1941. Sonoma County ranked third among the mercury-producing counties of the country in output of mercury in 1945, and the Mount Jackson mine was the third largest producing mine, having moved up from fourth place held in 1944. Production of Mount Jackson gained over 1944, a movement contrary to the trend for the country as a whole. C. A. Baumeister & Sons produced mercury in a 20-ton rotary furnace at the Culver-Baer mine; Severs, Landrebe & McPherson produced a small quantity in an inclined retort of 1½ tons capacity; and one other operator had a small output. The Bradley Mining Co. was doing some exploratory work at the Cloverdale mine in 1945, but no mercury was produced there in that year. A new development adit was run at the Riley-Contact mine in 1945 by H. G. Walker, who reported no production in that year. A 4- by 50-foot (50 tons daily capacity) rotary furnace is said to be on the property.

The Marsman Co. of California, operating the Altoona mine, was again the only producer of mercury in Trinity County in 1945. A rotary furnace of 30 tons rated capacity was used at this mine. The Altoona was the ninth largest mercury-producing mine in the United States in 1944, but it dropped from the list of important producers in 1945.

The Bradley Mining Co., operating the Reed mine, was again the only producer in Yolo County. The Reed was fourth in output among the mercury mines of the country, having dropped from second place held in 1944. Production at this mine fell 22 percent in 1945 following the advance in 1944 of 92 percent over 1943.

Idaho.—Bonanza Mines, Inc., produced mercury at the Hermes mine, Yellow Pine district, Valley County, in 1945, accounting for the only output of mercury in the State. A total of 7,330 tons of ore and dump material was treated in 1945 in one or both of the two 4- by 60-foot Gould rotary furnaces at the mine, and 627 flasks of mercury were recovered. The Hermes ranked as the seventh largest mercury-producing mine in 1944 but dropped somewhat below the first 10 places in 1945, when output fell 53 percent. The company reported that 1,000 feet of development drifting had been done during 1945.

Nevada.—Nevada was the second-largest mercury-producing State in 1945, a place not held since 1930. The assumption of this high

[8] Mining World, New Almaden, Still Going Strong After 120 Years of Operation: Vol. 7, No. 8, July 1945, pp. 42–43.

position is due to the sharp gain in output of mercury at the Cordero mine, Humboldt County, and to declines in or discontinuance of production at the Bonanza, Horse Heaven, Bretz, Opalite, and Black Butte mines in Oregon and at the Big Bend, Fresno, Chisos, and Rainbow mines in Texas. The total of 4,338 flasks for 1945 fell short of the peak output of 4,764 flasks in 1929 but was second to that year only. Production was high in 1929 because of the outputs of the Nevada Quicksilver and Pershing mines in the Antelope Springs district, Pershing County; the B. & B. and Red Rock (Good & McKinney) mines in the Fish Lake Valley district, Esmeralda County; and the Castle Peak mine in the Castle Peak district, Storey County. Of the properties listed for Nevada, only the Red Rock was active in 1945. The 4,338 flasks of mercury produced in Nevada in 1945 were recovered from 18,939 tons of ore, indicating a recovery of 17.4 pounds of mercury to a ton of ore or 0.87 percent.

There were no productive operations at mercury mines in Elko County in 1945.

W. F. Dunnigan produced 60 flasks of mercury at the Red Rock mine, Fish Lake Valley district, Esmeralda County, from 280 tons of ore treated in a Gould rotary furnace.

In all, 4,050 flasks were produced in Humboldt County in 1945, making this county the second most important in mercury production in the United States. The Cordero mine, operated by the Cordero Mining Co., was second only to the New Idria mine, San Benito County, Calif., as a producer of mercury in the United States in 1945, output having risen against the trend for most areas. In 1944 the mine ranked sixth and in both 1945 and 1944 stood first in Nevada. The mercury produced in 1945 was 166 percent greater than in 1944, while the tonnage of ore treated gained only 54 percent, indicating a noteworthy rise in the grade of ore treated. Bradley[9] said that a "magnificent ore body" had been found at the Cordero mine. The property was about to be closed, he said:

> * * * when its management decided on a campaign of churn drill prospecting. This paid off to the extent of high-grade ore down to 600 feet, which not only changed the ore reserves picture but toppled the long-held theory that cinnabar ore could only be relatively shallow in Nevada.

Production in 1945 was again from the large Herreshoff furnace on the property. Several smaller producers were Geo. H. Johnson operating the Cahill mine, C. D. Edmondson the Blackrock, John Mayeroff the Santa Rosa, and A. Gilmet the Grayson. Other properties, including some formerly large producers, were inactive in 1945.

The Hitt claim, operated by E. W. Morris, is believed to have been the only productive mercury property in Mineral County in 1945. A small quantity only was involved.

Very little mercury was produced in Nye County in 1945.

Young & MacAfee Enterprises operated a furnace at the Red Bird mine, Antelope Springs district, in 1945 and was the largest producer in Pershing County. Output for the county totaled 214 flasks or less than one-third of the 1944 total. The Pershing mine, largest producer in the county in 1944, was idle throughout 1945; and the Red Bird mine, already mentioned, was shut late in August 1945. Other

[9] Bradley, Worthen, work cited in footnote 7.

producers in the county in 1945 included Melvin McCoy at the Goldbanks mine, where the ore was retorted, and two others.

Oregon.—Oregon lost its place to Nevada as the second most important mercury-producing State in 1945. Production of 2,500 flasks was 21 percent below 1944 and 72 percent below 1941 and 1940. The Bonanza mine was by far the largest producer in the State and increased its dominant position by supplying 94 percent of the State's total. Of the total output, 2,425 flasks were recovered from 12,612 tons of ore, indicating a recovery of 14.6 pounds of mercury to a ton of ore or 0.73 percent. The remaining metal was recovered from furnace clean-up and dumps.

The output of 75 flasks of mercury from 32 tons of ore in Crook County is outstanding in the United States, where production is largely from low-grade ores. Eickemeyer Bros., operating the Maury Mountain mine, was the largest producer, and contributions to the total were made also by Frank S. Towner, operating the Lost Cinnabar No. 1, and the Amity Mining Co., operating the Amity mine. The three mines are in the Ochoco district, and retorts are used at each property.

As usual, the Bonanza mine of Bonanza Mines, Inc., was the outstanding mercury producer in Oregon in 1945, and in that year its dominant position was strengthened despite a decrease of 3 percent in output. The mine continued to hold fifth place in the United States. At Bonanza 2,350 flasks of mercury were recovered from furnacing 12,580 tons of ore, compared with 2,426 flasks from 15,547 tons of ore in 1944, indicating an increase in the average mercury content of the ore treated in 1945. Production was made in a Gould rotary furnace. In 1944 the company reported a Herreshoff plant also at the mine.

A small output of mercury at the War Eagle mine in Jackson County was reported.

The Horse Heaven mine, Jefferson County, has been the second most important mercury-producing property in the State in recent years; it ranked tenth in the United States in 1944. A fire at the mine closed operations on November 22, 1944, and output in 1945 was confined to clean-up activity at the furnace site.

Three properties that have produced important quantities of mercury in the past—the Black Butte in Lane County and the Bretz and Opalite in Malheur County—were idle in 1945.

Texas.—The Esperado Mining Co., operating the Chisos and Waldron properties, Terlingua district, Brewster County, was the only producer in Texas in 1945. Output for the State declined because the Fresno mine, Presidio County, which ranked first in the State by a narrow margin in 1944, was inactive in 1945. The larger output at the Chisos and Waldron mines in 1945 was insufficient to offset the inactivity in that year of the Fresno and two smaller properties which were productive in 1944.

CONSUMPTION AND USES

The record-breaking rise in consumption of mercury in 1945 was described in the opening section of this report. The rapid development of the new-type dry-cell battery for war uses, calling for enormous

717372—47——46

quantities of mercury, has been one of the outstanding features of the mercury industry for all times. The question as to the possibilities of adapting the battery to large-scale peacetime use is the most important one now facing the industry. A beginning has been made in this direction, and batteries for hearing aids are already on the market. Numerous other prospects are being explored.

A newly developed mercury "clutch" for fractional horsepower electric motors, to be used in washing machines, air-conditioning units, refrigerator equipment, and other ways, is claimed to have promise. Mercury chemicals protected millions of yards of military fabric from mildew. A recent advertisement told of a powerful new mercury fungicide with marked water-repellent properties, which protects textiles, felt, cork, paints, lacquers, varnishes, oils, greases, waxes, paper, leather, and wood from mildew, mold, rot, and other forms of destruction by microbes.

Mercury cells for the electrolytic production of chlorine and caustic soda have recently received considerable publicity.[10] The editorial notes in connection with the first article were as follows:

> Of the half hundred alkali-chlorine plants in this country, only four use the mercury cathode type of cell. Yet this cell, about which comparatively little has been published, has certain advantages over other designs more widely used. It produces, for instance, a caustic soda solution that needs no further purification even for the rayon trade. Attention is now being directed to basic advantages of the mercury cathode cell.

As indicated in the section on Germany, war expansion of the German caustic soda and chlorine industry was in mercury cells. Earlier reports of this series pointed out Germany's favorable position during the war in regard to supplies of mercury and the practicability of putting mercury to widespread use there.

Mercury-arc rectifiers as a source of direct-current power for mill drives were recently discussed.[11]

The development of new chemicals, such as the sulfa drugs and penicillin, may curtail the consumption of mercury in pharmaceutical uses.

Supply of mercury in the United States, 1941–45, in flasks of 76 pounds

Year	Production	Imports for consumption	Exports	Consumption
1941	44,921	7,740	2,590	44,800
1942	50,846	[1] 38,941	[1] 345	49,700
1943	51,929	[1] 47,805	[1] 385	54,500
1944	37,688	19,553	750	42,900
1945	30,763	68,617	1,038	63,900

[1] Large quantities were reexported in 1942 and 1943.

[10] Gardiner, W. C., Basic Principals and Operating Characteristics of Mercury Cells: Chem. and Met. Eng., vol. 52, No. 7, July 1945, pp. 110–113.
Hunter, Ralph M., German Chlorine, a Report on Production Methods: Chem. and Met. Eng., vol. 52, No. 9, October 1945, pp. 104–106 and 112.
Chemical and Metallurgical Engineering, Germany's Vertical Rotating Cathode, Mercury Cell: Vol. 53, No. 1, January 1946, pp. 113–115.

[11] Iron and Coal Trades Review, Mercury-Arc Rectifier Operation of Mill Drives: Vol. 150, No. 4023, April 6, 1945, p. 518.

Mercury consumed in the United States, 1944–45, in flasks of 76 pounds

Use	1944 [1]	1945 [1]	Use	1944 [1]	1945 [1]
Pharmaceuticals	8,358	11,133	Electrical apparatus	7,092	[2] 24,468
Dental preparations	442	513	Industrial and control instruments	[3] 3,249	[2] 3,250
Fulminate:			Amalgamation	29	183
Munitions, Blasting caps	1,890	1,133	General laboratory	265	309
Agriculture	3,930	2,863	Redistilled	[3] 6,613	[2] 9,647
Antifouling paint	2,439	1,661	Other	2,236	2,739
In the electrolytic preparation of—				[1] 42,900	[1] 63,900
Chlorine, Caustic Soda	657	632			
As a catalyst	4,764	3,654			

[1] The items are on a partial-coverage basis and do not add to the total, which has been increased to cover approximate total consumption.
[2] A large part of the quantity shown under "Redistilled" was for use in industrial and control instruments and a large part was for the manufacture of the new-type batteries.
[3] About half of the quantity shown under "Redistilled" was for use in industrial and control instruments.

Mercury consumed in the United States, 1940–45, by months, in flasks of 76 pounds

Month	1940	1941	1942	1943	1944	1945
January	2,300	2,900	3,800	4,500	3,400	5,200
February	2,000	4,700	3,000	4,700	3,700	5,100
March	1,800	4,000	3,500	4,900	3,600	6,100
April	1,900	3,200	3,600	5,500	3,200	7,500
May	2,200	3,500	4,200	5,600	3,100	8,900
June	2,500	3,300	3,700	4,700	3,400	8,500
July	2,200	3,300	3,200	4,700	3,000	6,600
August	2,100	3,600	3,700	4,900	3,900	5,300
September	2,100	3,700	4,100	4,100	3,900	3,100
October	2,700	4,800	6,200	3,800	3,900	3,100
November	2,900	3,900	6,200	3,900	3,900	2,500
December	2,100	3,900	4,500	3,200	3,900	2,000
	26,800	44,800	49,700	54,500	42,900	63,900

STOCKS

Consumers' and dealers' stocks of mercury undoubtedly reached a new high level in 1945, although the statistical record covers the period since September 1939 only. For the period September 1939 to the end of 1944 consumers' and dealers' stocks fluctuated from a high point of 15,300 flasks at the end of August 1942 to a low point of 7,400 flasks at the end of October 1944. The record for 1945 cannot be considered normal and resulted from the same factors that influenced prices (discussed under Prices). After the record high receipts of mercury from abroad in July, industry stocks were at double the highest levels of the preceding 5-year period and more. Month-end inventories continued at the inflated levels for 3 months and even rose 13 percent over the July total to 37,800 flasks at the end of October. The absorption of surplus stocks from Government contract cancelations into the permanent stock pile caused a reduction in industry stocks to 17,000 flasks by the end of December, and of this total a large quantity was scheduled for the Government inventory.

Producers that regularly account for more than 95 percent of the total domestic output held (not necessarily owned) large stocks of mercury in 1945, but at no time were such stocks as large as they had been early in 1944. Producers held 3,200 flasks at the end of 1945 compared with 2,700 flasks at the end of 1944 but at the high point for 1945 (September) had only 4,200 flasks compared with 6,200 flasks at the end of May 1944. The May 1944 stocks must have been larger than at any other time since 1900 at least and may never have been exceeded.

Stocks held by the Office of Metals Reserve fluctuated little in 1945 after the end of January. They were 67,812 flasks at the beginning of the year and were reduced to 63,067 flasks in January to accommodate war orders. At the end of the year 63,638 flasks were held.

Data covering metal in the permanent Government stock pile are not available for publication.

PRICES

Mercury prices were subject to rather violent fluctuations after the beginning of World War II. Following the establishment of ceiling limitations in February 1942 the price was stabilized at close to the ceiling for almost 2 years. In 1944 and 1945 the price fluctuated severely beneath the ceiling and in this regard was in contrast to the inaction of virtually all commodities subject to price controls. The relationship between supplies and requirements was reversed in 1943, when supplies became adequate and even abundant for anticipated needs, and this new condition caused the price to drop sharply from December 1943 to July 1944. The monthly price was $196 a flask at New York in August 1943; it was $190.08 in December, $151.60 in January 1944, and $100.56 in July. The anticipation of new record rates of consumption due to the development of the new dry-cell battery, of which mercuric oxide is an important component, caused the price to jump to $165.55 in February 1945. The expectation that enough mercury for the expanded consumption would be

Average monthly prices per flask (76 pounds) of mercury at New York and London, and excess of London price over New York price, 1943–45

Month	1943			1944			1945		
	New York [1]	London [2]	Excess of London over New York	New York [1]	London [2]	Excess of London over New York	New York [1]	London [2]	Excess of London over New York
January	$196.00	$281.44	$85.44	$151.60	$281.44	$129.84	$156.85	$281.44	$124.59
February	196.00	281.44	85.44	130.00	281.44	151.44	165.55	281.44	115.89
March	196.00	281.44	85.44	130.00	281.44	151.44	162.00	281.44	119.44
April	196.00	281.44	85.44	128.20	281.44	153.24	156.84	281.44	124.60
May	196.00	281.44	85.44	115.54	281.44	165.90	153.69	281.44	127.75
June	196.00	281.44	85.44	101.69	281.44	179.75	147.73	281.44	133.71
July	196.00	281.44	85.44	100.56	281.44	180.88	140.72	281.06	140.34
August	196.00	281.44	85.44	104.04	281.44	177.40	123.20	280.88	157.68
September	195.72	281.44	85.72	104.28	281.44	177.16	95.84	280.74	184.90
October	195.00	281.44	86.44	109.20	281.44	172.24	101.39	126.01	24.62
November	193.70	281.44	87.74	116.30	281.44	165.14	106.87	126.06	19.19
December	190.08	281.44	91.36	128.88	281.44	152.56	108.00	126.05	18.05
Average	195.21	281.44	86.23	118.36	281.44	163.08	134.89	242.45	107.56

[1] Engineering and Mining Journal, New York.

[2] Mining Journal (London) prices in terms of pounds sterling are converted to American money by using average rates of exchange (official for January 1943 through June 1945 and free thereafter) recorded by Federal Reserve Board. Official prices were £68 10s. to £69 15s. until October 1945, when they were reduced to £30 to £31 5s.

forthcoming from Spain, and the actual receipts of record-breaking quantities therefrom, brought reversal of the new price movement in 1945. The end of World War II, followed by the canceling of Government contracts for batteries, accelerated the price drop to \$95.84 a flask in September. Removal from the market of surplus stocks from Government contract cancelations for the permanent stock pile was responsible for the return of somewhat higher prices in the final quarter of the year; in December the average price was \$108.

Control maximum prices in London remained unchanged from those during the late months of 1942 until October 1945 at £69 15s. a flask for over 1 flask and less than 11 flasks and £69 for larger quantities, ex sellers' premises in both cases. Prices dropped to less than half when they changed in October 1945 and were £30 to £31 5s. a flask.

FOREIGN TRADE [12]

One of the features of the mercury industry in 1945 was the high record rate of imports during the year. Imports for consumption totaled 68,617 flasks, or 251 percent more than in 1944 and 44 percent above the previous peak in 1943. The foregoing gains were caused by the enormous demands for mercury due to the war requirements for the new dry-cell batteries. The need to acquire large supplies very rapidly turned the attention of manufacturers to Spain. Receipts of 55,391 flasks of mercury from Spain alone would have been sufficient to establish a new annual peak by a noteworthy margin for total United States imports; but, in addition, 10,853 flasks came from Mexico, 1,720 from Canada, 477 from Chile, 153 from Peru, and 23 from Honduras. Spain had not shipped to the United States since 1941 and then only 104 flasks. Receipts from Mexico declined 36 percent in 1945, and those from Chile dropped 51 percent. While those from Canada increased 10 percent, the small quantity from Peru was virtually trebled, and that from Honduras marked the entry of a new item from that country.

General imports may differ considerably from imports for consumption and are a better guide to actual entries into the country during a specified period. General imports totaled 71,508 flasks in 1945 and 19,819 flasks in 1944. The distribution by countries (comparisons with 1944 in parentheses) were as follows: Canada, 1,720 (1,564); Chile, 751 (982); Honduras, 23 (—); Mexico, 13,082 (17,221); Peru, 185 (52); and Spain, 55,747 (—). Imports from Canada were from stocks, inasmuch as the mercury mines of the country were idle in 1945. The entry of metal into the United States was highly concentrated in three periods, that is, April–May, July, and November. April imports marked a new high record monthly total, those for July were not far from double the April rate, and those for November were only a little less than the total for July.

No imports of mercury compounds were recorded in either 1945 or 1944.

Exports of mercury rose 38 percent in 1945 following a sharp increase in 1944 but despite these gains were insignificant in relation to the import movement. The total of 1,038 flasks shipped in 1945

[12] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Mercury imported for consumption in the United States, 1941–45

Country	1941		1942		1943	
	Pounds	Value	Pounds	Value	Pounds	Value
Canada	59,633	$130,468	562,348	$1,337,640	1,184,211	$3,009,271
Chile			107,091	266,920	202,148	506,710
Honduras						
Mexico	520,692	1,171,752	2,288,505	5,122,516	2,238,725	5,010,038
Nicaragua			1,545	3,395		
Peru					8,132	19,934
Spain	7,903	6,373				
Total: Pounds	588,228	1,308,593	[1] 2,959,489	6,730,471	[1] 3,633,216	8,545,953
Flasks	7,740		[1] 38,941		[1] 47,805	

Country	1944		1945	
	Pounds	Value	Pounds	Value
Canada	118,906	$337,177	130,720	$237,175
Chile	74,627	152,309	36,285	55,995
Honduras			1,748	3,621
Mexico	1,288,548	2,012,873	824,789	1,296,851
Nicaragua				
Peru	3,944	9,397	11,628	19,570
Spain			4,209,720	7,386,167
Total: Pounds	1,486,025	2,511,756	5,214,890	8,999,379
Flasks	19,553		68,617	

[1] 567,059 pounds (7,461 flasks) were reexported in 1942 and 1,128,727 pounds (14,852 flasks) in 1943. These quantities cannot be separated by countries of origin.

represented only 1 percent of general imports of mercury in the same year. Sweden received 600 flasks in 1945 (compared with none in 1944), and no other country received more than 10 percent as much. The larger quantities shipped in 1945 (comparison with 1944 in parentheses) went to the countries discussed below. Brazil was the destination of 62 (227) flasks, Iran 51 (6), Venezuela 33 (21), Colombia 29 (28), Canada 26 (25), and no other country as much as 25 flasks. Altogether 66 countries received mercury exported from the United States in 1945. The distribution of exports by continents was as follows: North and Central America (including the West Indies), 98 (109) flasks; South America, 138 (295) flasks; Europe (including U. S. S. R.), 675 (105) flasks; Asia, 86 (79) flasks; Africa, 40 (46) flasks; and Oceania, 1 (116) flask.

Mercury exported from the United States, 1941–45

Year	Pounds	Flasks of 76 pounds	Value	Year	Pounds	Flasks of 76 pounds	Value
1941	196,837	2,590	$470,903	1944	57,007	750	$123,481
1942	26,252	345	76,448	1945	78,852	1,038	121,615
1943	29,236	385	88,842				

Reexports of mercury rose sharply in 1945, particularly because of Sweden's requirements for metal. In addition to the previously mentioned exports of 600 flasks to Sweden in 1945, 1,211 flasks of mercury that were imported into the United States in an earlier period were reexported to that country in unchanged form. Brazil was the destination of 172 flasks of reexported mercury, Canada and Belgium-Luxembourg were shipped 75 flasks each, and Argentina was sent 73 flasks. No other country received more than 20 flasks. Reexports totaled 1,693 flasks compared with 126 flasks in 1944.

Exports of mercury salts do not represent very significant quantities of equivalent metal. The exports of compounds in 1944 and 1945 are shown in the following table. A sharp drop in shipments of mercuric fulminate and a substantial increase in those of mercuric oxide in 1945 will be noted from examination of the table, which also shows that miscellaneous mercury compounds rose notably in 1945.

Mercury salts exported from the United States, 1944–45, in pounds

	1944	1945		1944	1945
Mercurous chloride (calomel)	21,351	23,901	Mercuric nitrate	446	35,746
Mercuric chloride (corrosive sublimate)	40,816	33,104	Mercuric sulfate	65	
Mercuric fulminate	26,190	506	Mercuric sulfide	222	
Mercuric oxide (red and yellow)	13,054	26,451	Other compounds	10,327	

WORLD PRODUCTION

Italy surpassed Spain in production of mercury in World War II until American forces arrived. The output of over 94,000 flasks in Italy in 1941 was an all-time record for all countries. Spain's output of 86,473 flasks in the same year was an all-time high record for that country. Each of these countries produced about 40,000 flasks in 1945. Italy's output was on the upgrade after the disintegration of

World production of mercury, 1938–45, by countries, in flasks

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Algeria	191	(1)	(1)	199	220	55	90	(1)
Australia:								
New South Wales	--------	--------	(2)	1	(2)	--------	--------	(1)
Queensland	--------	3	37	34	15	15	12	(1)
Bolivia (exports)	--------	7	--------	--------	--------	51	2	3
Canada	10	6	2,024	7,057	13,630	22,240	9,682	--------
Chile	44	(1)	(1)	1,305	2,256	2,563	1,175	(1)
China (free)	560	4,931	3,403	6,527	4,728	[3] 3,423	[3] 2,988	(1)
Czechoslovakia	2,900	[4] 2,669	[4] 2,582	(1)	(1)	(1)	(1)	(1)
Germany	1,392	1,218	957	899	493	(1)	(1)	(1)
Austria	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Italy	66,752	67,154	91,230	94,160	75,885	[3] 60,000	[3] 35,000	[3] 40,000
Japan	592	(1)	(1)	660	(1)	(1)	(1)	(1)
Korea (Chosen)	16	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Mexico	8,519	7,376	11,653	23,137	32,443	28,321	26,063	16,443
New Zealand	10	--------	--------	73	150	93	90	(1)
Peru	--------	--------	--------	--------	145	[5] 326	[5] 153	[3] 209
Rumania	--------	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Southern Rhodesia	--------	(2)	(1)	(1)	(1)	(1)	(1)	(1)
Spain	41,409	35,912	52,214	86,473	72,288	47,756	68,938	40,089
Tunisia	270	58	149	88	(1)	525	(1)	(1)
Turkey	597	359	500	242	176	186	97	220
Union of South Africa	--------	--------	(1)	204	579	1,189	1,192	[6] 642
U. S. S. R.	[7] 8,700	(1)	(1)	(1)	(1)	(1)	(1)	(1)
United States	17,991	18,633	37,777	44,921	50,846	51,929	37,688	30,763
Total [3]	150,000	145,000	210,000	275,000	260,000	230,000	190,000	135,000

[1] Data not yet available; estimates included in total.
[2] Production less than 1 flask.
[3] Conjectural.
[4] Slovak Metallurgical Works.
[5] Exports.
[6] January to September, inclusive.
[7] Production figure published by Metallgesellschaft.

the industry that followed destruction of power plants by the retreating German forces and restriction of production to permitted power consumption under American Army regulations. Spanish production was low in 1945 chiefly because of large stocks of metal on hand in that country at the beginning of the year. Canada's recently developed mines were idle in 1945, and Mexican output was only 63 percent of that in 1944.

REVIEW BY COUNTRIES

Australia.—From time to time a small output of mercury has come from Australia, but this country depends on imports to fill internal needs for the metal. Only 12 flasks were recovered in 1944 compared with 15 in 1943 and with a peak during the war period of 37 flasks in 1940. Meanwhile imports aggregated 689 flasks in 1944, 1,323 in 1943, 1,460 in 1942, and 1,232 in 1940. Before the war mercury was imported chiefly from Italy and Spain, with Canada, New Zealand, the United States, and the Union of South Africa supplying the market after the war began.

Canada.—Recent activity in mercury mining in Canada coincided with war needs for the metal; production began to attract international attention in 1940, when 2,024 flasks were recovered, rose to a peak of 22,240 in 1943, and terminated when requirements appeared to be taken care of in 1944, ahead of the war's end. There was no production in 1945. The principal work was at the Pinchi Lake deposit, mentioned in previous reports of this series. The plant at Pinchi Lake had been enlarged from the original 50-ton unit in 1940 to the 1,200-ton daily capacity plant at the property when it closed in July 1944. Both Consolidated Mining & Smelting Co. of Canada, Ltd., which operated the Pinchi Lake deposit, and Bralorne Mines, Ltd., the other important mercury-producing company in Canada, have major interests in the production of lead, zinc, and gold, and the mercury operations represented a relatively minor activity for either company.

Germany.—Since the end of World War II, data that confirm the belief that record-breaking quantities of mercury were entering and being used in Germany have become available. The only important source of mercury in Germany is the Landsberg mine and plant at Obermoschel in the Rheinische Palatinate near Bingen. The following figures on production, imports, and exports (converted to flasks) were published [13] soon after the war's end.

Mercury produced in, imported into, and exported from Germany, 1935–44, in flasks of 76 pounds

Year	Production	Imports	Exports
1935	116	24,918	435
1936	1,102	19,958	348
1937	174	25,904	174
1938	1,363	32,866	58
1939	1,102	24,802	116
1940	870	84,326	87
1941	522	66,457	551
1942	522	49,372	435
1943		60,076	5,570
1944		24,860	1,363

[13] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 2, August 20, 1945, p. 22.

The following notes regarding mercury consumption in Germany were recently published: [14]

The war expansion of the German caustic soda and chlorine industry was in mercury cells, although existing Billeter cell installations were operated as required. The trend to mercury cells increased rapidly in 1937 at which time mercury was very cheap in Germany due to political connections with Spain. The Germans were well satisfied with the mercury cell, however, and it did eliminate expensive evaporation equipment. The largest cells under construction at the close of the war were 28,000 amp. which were believed to be the largest capacity chloride cells in the world. The usual 16,000 amp. cells required 4.5–5.0 v. and had a current efficiency of 94–95 percent.

A new and very interesting vertical rotating mercury cell was used in the most recent plant expansions. This cell required much less floor space than the conventional horizontal cells. A trend toward liquefaction of chlorine by means of higher compression followed by water cooling without artificial refrigeration was noted. A new type of rectifier, which was alleged to operate at high efficiency in the lower voltage range, was employed in at least two of the newer installations.

German chlorine practice was described in detail later, and the references are given under the section on Consumption and Uses.

It is reported [15] that American occupation forces found 51,500 flasks of mercury stored in the Mansfeld mine near Eisleben.

Italy.—Figures made available recently [16] show that the Italian mercury industry produced at new record high rates during World War II, the production peak of 94,160 flasks for 1941 surpassing the prewar peak level of 67,000 for 1937–39 by more than 40 percent. Italy's production of 94,160 flasks was the largest output for any country for any year up to the present. Production figures, including estimates for the period of occupation by Germany, are given in the foregoing world table. For 1940 to 1945 production totaled 396,000 flasks. Exports were reported as 73,680 flasks in 1940, 47,544 in 1941, 41,278 in 1942, 46,000 in 1943, none in 1944, and 4,400 in 1945, or a rounded total of 213,000 flasks for the 6-year period. Since Italian consumption of mercury is small and is reported to permit exportation of 85 to 95 percent of production and since stocks of mercury at the beginning of American occupation of Italy were small, the large difference between production and exports may have resulted from unreported requisitioning of considerable mercury by the Germans. Stocks at the end of 1945 exceeded 25,000 flasks, and the production rate at that time approximated 3,500 flasks a month.

For the period 1938–43 the Abbadia San Salvatore mine produced 46 percent of Italy's total output of mercury, Solforate del Siele 32 percent, other Tuscany mines 7 percent, and Idria 15 percent. At the end of 1945 the Idria mine was in the hands of the Yugoslavs.

Conditions at Italian mines when the Americans arrived were described briefly in the 1944 report of this series. The Abbadia San Salvatore, owned by Società Anonima Mineraria Monte Amiata, in which the Italian Government has a controlling interest, on the east slope of Monte Amiata, is developed by adits, shafts, and several levels to a depth of 165 meters below the surface. The horizontal cut-and-fill method is used to extract the ore. Waste is sorted from the ore in the stopes and used for back filling. Compressed-air rock drills and electric locomotives were temporarily replaced by hand drilling,

[14] Chemical and Metallurgical Engineering, vol. 52, No. 9, September 1945, p. 200.
[15] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 2, August 20, 1945, p. 14.
[16] Several reports prepared by C. A. Botsford, minerals attaché, Rome, Italy.

hand tramming, and animal haulage because of the power shortage, but this situation is being eased. The Siele mine, situated 7 miles south of Monte Amiata and owned by Società Anonima Stabilimento Minerario del Siele, is developed by a shaft and several levels. Mining methods are similar to those at the Abbadia mine. The Abbadia mine uses tower furnaces for the coarse ore and Cermak-Spirek furnaces (similar to the Scott furnace) for the fines. The Siele and most of the other mines use the Cermak-Spirek furnaces only.

Based on the 1940 output, the developed ore reserves in Tuscany are sufficient for about 8 years, whereas the tonnage of probable and possible reserves indicates that these mines will continue to be productive for many decades. The grade of ore mined has averaged 1.29 percent in recent years. Reserves at the Idria mine, Province of Gorizia, are said to be limited to less than a decade at a normal rate of production. Production in 1938–43 averaged 0.6 percent mercury.

Mexico.—Production of mercury in Mexico during the past few years was an important increment to the total Western Hemisphere supply when trade with European countries was difficult or impossible. United States Government mercury contracts with Mexico were terminated in 1944. Production of 26,063 flasks in that year was 20 percent below the peak for 1942, which in turn approximately equaled the total for the 5-year period 1935–39. Production of 16,443 flasks in 1945 was 37 percent less than in 1944 but continued at more than two and one-half times the prewar levels. Exports from Mexico totaled 14,968 flasks in 1945 compared with 23,525 flasks in 1944. After the beginning of World War II, exports were destined largely for the United States.

Peru.—Two furnaces, with a combined daily capacity of close to 250 tons, were under construction at the old Santa Bárbara mine a few miles south of Huancavelica in 1945. The proposed construction of the two plants was mentioned first in the report of this series for 1942, but failure to receive shipping permits to move the plants out of the United States, where they were designed, and shortage of construction materials in Peru delayed completion of the plants.

Spain.—At the outset of 1945 large stocks of mercury were held at the Almaden mine, and the mine was inoperative. Production was begun at the furnaces in May from the treatment of ores stocked in 1944. Spain's total output for the year was 40,089 flasks. The grades of ore mined in recent years have been as follows: 1940, 6.1 percent; 1941, 7.0 percent; 1942, 8.0 percent; and 1943 and 1944, 5.8 percent.

The total for 1941 was Spain's all-time production peak. Almaden has had the longest record of production and the largest production total of all mercury mines in the world. According to Hewett,[17] production probably was begun in Almaden about 400 B. C. Recorded production dates back to 1500 and is as follows:

Period	*Flasks*	*Period*	*Flasks*
1500–1699	684, 826	1875–99	1, 143, 460
1700–1799	1, 311, 693	1900–1925	737, 375
1800–1849	1, 093, 714	1926–44	937, 339
1850–74	633, 333		
			6, 540, 740

[17] Hewett, D. F., Cycles in Metal Production: Am. Inst. Min. and Met. Eng., Tech. Pub. 183, 1929, p. 21.

Turkey.—Production of mercury in Turkey declined from 815 flasks in 1936 to 97 in 1944; in both years the total came from the Ahirli and Karareis mines in the Karaburun district of Izmir.

United Kingdom.—In October 1945 control prices for mercury, which had been held at £69 to £69 15s. a flask, depending on quantity, from August 1942, were reduced £38 10s. a flask to £30 to £31 5s. a flask. The new price is equivalent to over $120 a flask and thus continued above the price in the United States. A plant for the production of the new battery that contains mercuric oxide was constructed recently at Belfast, Ireland, and was to be operated by P. R. Mallory & Co., Inc., which controls the patents for the manufacture of the batteries.

TIN

By C. E. Nighman and J. B. Umhau

SUMMARY OUTLINE

GENERAL SUMMARY

Of greatest importance to tin consumers and producers in 1945 was the unexpectedly early fall of Japan in August, which made it possible to begin reoccupation and rehabilitation of the Far East tin provinces. As the first authentic reports on the physical status of the tin mines, plants, equipment, and smelters and on economic and political conditions were received late in the year and early in 1946, it became increasingly evident that the present tin supply could not be greatly increased for 2 years or more. Because of an expected great world demand, it thus appeared requisite to continue restraints on use to avoid a run-away market and to permit equitable distribution of the apparently shrinking total world supply. However, in the light of newly available data on wartime experience, it appears that the world's basic tin requirements should be reappraised. After the United States became directly involved in the World War—that is, for 1942–45—world pig-tin consumption was, on the average, only 100,000 tons, of which at least 10,000 tons were consumed in bronzes for wartime ship construction. For that period there is at hand no evidence of the imposition of undue hardships, at least, on ultimate users of tin-bearing materials. In other words, the record shows that the inelastic portion of use is substantially lower than commonly has been assumed in recent years. To reach a 150,000-ton annual consumption level, much less than the figure of 250,000 tons forecast by the Tin Producers' Association, the future price of tin cannot greatly exceed the current price between 50 cents and 60 cents a pound.[1] As a corollary, if the tin industry is to achieve any reasonable stability there can be no room for the reintroduction of marginal or uneconomic enterprises. In view thereof and of Bolivia's peculiar position, it appears inevitable that some type of international accord for production and marketing will have to be established.

[1] In the Postwar Outlook for Tin, Minerals Yearbook, 1943, pp. 732–744, the authors had already pointed to this conclusion. See also Minerals Yearbook, 1944, p. 718.

Salient statistics for tin in the United States, 1925–29 (average) and 1941–45

	1925-29 (average)	1941	1942	1943	1944	1945
Production—						
From domestic mines......long tons..	24	56.3	6.3	6	5	----------
From domestic smelters........do....	----------	[1] 1,839	[1] 16,168	[1] 21,489	[1] 30,884	[1] 40,475
From secondary sources........do....	30,600	37,500	33,900	33,800	29,100	31,400
Imports for consumption:						
Metal........................do....	78,009	140,873	26,753	12,030	13,338	8,440
Ore (tin content)..............do....	175	28,670	28,933	21,857	35,548	33,527
Exports (domestic and foreign).....do....	1,740	[2] 1,094	409	1,770	843	882
Monthly price of Straits tin at New York:						
Highest............cents per pound..	70.67	53.35	(3)	(3)	(3)	(3)
Lowest......................do....	39.79	50.16				
Average......................do....	56.64	52.01				
World production............long tons..	163,000	240,000	125,000	127,000	105,000	87,000

[1] Including tin content of ores used direct to make alloys.
[2] Figures cover foreign only; domestic not separately recorded.
[3] Ceiling price, 52 cents.

No domestic production of ore or concentrates was recorded in 1945. Worthy of note was the recession of world production to or near the lowest point in 45 years. Consumption of primary tin in the United States, 55,640 long tons, was nearly 6 percent below that of 1944 and in the United Kingdom, 16,920 tons, was about 8 percent below that of the preceding year and at the lowest point for more than 10 years. Domestic reversion to the peacetime consumption pattern was most in evidence in the drop of approximately 5,000 tons or about 34 percent in the use for bronze as a result of the sharp contraction in the ship-construction program. On the other hand, tin-plate and solder uses rose 4 percent and 24 percent, respectively, compared with the previous year. A parallel change was observed in the United Kingdom. Imports of metal and concentrates, 41,967 long tons (tin content), were 14 percent below those of 1944. Slightly more than half of the decline was in the form of metal from the Belgian Congo as a result of diversions to Europe after VE-day and about 20 percent owing to a decrease in Chinese receipts. The remainder, in the form of concentrates, was mostly attributable to the drop of 1,717 tons in Bolivian receipts. Tin plate and terneplate, which were, as usual, the major exports, rose 8 percent over the 1944 level to 471,149 long tons and although about 21 percent below the 1942 peak were nevertheless the second highest of record.

The year-end tin stock position remained relatively satisfactory, although declining during the year about 15,400 tons to 95,000 tons, divided as follows: Industry pig-tin stocks (including anodes and reclaimed tin), 27,500; Government, 35,000; and in ores, 32,500 tons. Of the Government stocks, 12,140 tons of pig tin are held by the Navy and Procurement Division of the Treasury Department and are not subject to distribution. The Civilian Production Administration estimated that 18,000 tons (tin content of ore and metal) are tied up in the Longhorn-smelter working stocks. As a consequence, the actual status was much inferior to the statistical position, and in view of the probability that new supply in 1946 would not be greater than in 1945 existing use controls would have to be extended at least through 1946. Although in the United States total stocks decreased on the average about 13,000 tons a year since the end of 1941, British stocks rose at an average annual rate of about 2,300 tons to 33,200 at the end of 1945 or nearly 2 years' needs at the 1943–45 average virgin-tin consumption rate. The United Kingdom from stock and new supply will therefore furnish much of the Continental and Empire requirements as well as make some deliveries to the United States. Up to the end of 1945, the distribution of all tin supplies to the United Nations had been in the hands of the Combined Raw Materials Board. It was then succeeded by the Combined Tin Committee, which allocates all metal, including captured enemy stocks, to claimant nations. Interim allocations for the first half of 1946 made in March indicate that the United States will receive about three-eighths of the available metal.

The Government tin smelter produced nearly 41,000 long tons of tin in 1945 and at the end of the year was operating at about a 44,000-ton rate.

The domestic price of Grade A tin was held constant at 52 cents a pound, unchanged since 1942. The British internal price was maintained for the second consecutive year at £300 a long ton (53.8 cents a pound) for standard tin, delivered buyer's works. The first price break was indicated in September, when the British set a price of £375 (67.3 cents a pound) for export. At the close of the year Office of Metals Reserve announced that the price for export would be raised above the internal price and set 58 cents a pound in March 1946.

GOVERNMENT TIN OPERATIONS

In 1945 all imported metal and concentrates were again for Government account. Commitments were made for 9,440 long tons of refined tin and 67,056 long tons (gross weight) of ore and concentrates compared with 15,732 tons and 84,318 tons, respectively, in 1944. Bolivia was to furnish 90 percent of the raw material, including a substantial part of the Patiño production that was under long-term contract for delivery to the United Kingdom, the remainder to be supplied by Belgian Congo and French West Africa. Belgian Congo also supplied about 55 percent and China 34 percent of the pig tin. The remainder comprised captured German and Japanese tin. The German material contained some solder, whereas the Japanese tin, found in the Philippines, was of high quality, essentially of Banka grade. Of the Chinese tin that had been flown out to India in 1944, a portion was diverted to other destinations, and about 1,900 tons arrived in the United States. At the end of the year, 19,467 tons of ore and concentrates were afloat or awaiting shipment from foreign ports.

Operation of the Longhorn tin smelter at least into 1947 appears necessary to meet metal needs, entirely aside from the national security aspect that has attained wide acceptance. Early in 1946 the Director of War Mobilization and Reconversion, in Congressional hearings relating to the extension of Reconstruction Finance Corporation authority to purchase foreign ores, recommended that the operation be maintained, as it was essential to national defense and would otherwise benefit the Government. In March 1946 permission [2] was

[2] 79th Cong., 2d sess., Public Law 328, approved Mar. 21, 1946.

given to Reconstruction Finance Corporation to purchase ores and concentrates deemed necessary to keep the smelter running, without limit as to time, and it was freed also from the provisions of the Emergency Price Control Act of 1942, as amended, and other enactments that forbade or limited subsidized or loss sales. Under the 52-cent-a-pound price fixed by the Office of Price Administration, when the cost of tin was essentially the same and with cost of Bolivian ores delivered in the neighborhood of 65–67 cents, the indicated smelter loss was about $12,000,000 in 1945.

The original 5-year ore-purchase contract with Bolivian producers was terminated June 30, 1945. Meanwhile, negotiations for renewal had been undertaken but were not concluded until September. The new contract runs only 1 year. Under its terms, payments for "payable" tin (total less soluble tin) were set on a quarterly basis, beginning with 63.5 cents a pound for the first quarter and declining successively 1.5, 1.5, and 2.0 cents a pound to 58.5 cents a pound in the fourth, f. o. b. vessel at Antofagasta or Arica, Chile, or Mollendo, Peru. The 1½-cent production incentive bonus of the preceding amended contract was retained, as were the smelting-loss deduction, treatment charges, and penalties for impurities. The rejection point remained as before at 18 percent payable tin.[3] In the first quarter of 1946 other contracts were made for purchase of Netherlands East Indies concentrates and metal.

GOVERNMENT CONTROLS

During 1945 the use of tin was controlled principally by War Production Board Orders M–43, tin conservation, and M–81, containers. There were numerous amendments to the orders that were more in the nature of adjustments among commodity group uses to meet changing conditions as hostilities came to an end and reconversion began than actual relaxations. Of the total supply in the country, about 40,000 tons are currently tied up in smelter working stocks, in in-process materials, and in industry stocks. It is believed that this quantity is not reducible to any extent. As the remainder, available for consumption, has become progressively smaller for 4 years, while the increments to be expected from world production (unlikely to be over 110,000 tons in 1946 and 175,000 tons in 1947) would not meet the anticipated new tin needs, further drafts will have to be made on the residual accumulation. Restrictions, but on a declining scale, thus will probably extend into 1947.

The general effectiveness of the conservation measures is reflected in the 4-year war-period average of virgin-tin consumption of about 54,000 long tons, notwithstanding some extraordinary wartime needs for tin-bearing materials. The major saving of tin was again in tin plate. The output of electrotinned plate in 1945 was 860,000 short tons, an increase of one-third over that of 1944, and it was equivalent to one-third of the total tin-plate production. Change in packing quotas and modification of class of plate permissible for various packs resulted in slight increases in average tin weights per ton. Electrolytic tin plate averaged 11.9 pounds and hot-dipped plate 27.2 pounds compared with 11.82 and 26.24 pounds in the preceding year. How-

[3] The text of the agreement was published in American Metal Market, vol. 52, No. 177, Sept. 18, 1945, p. 5.

ever, as a consequence of the greater use of electrolytic plate, the average coating for all tin plate was, at 21.9 pounds, 0.4 pound less than in 1944. In the other large fields of application, a sample based on the returns of identical companies heretofore used showed essentially no change. In bronze and brass and in solder the indicated average tin content was the same as in 1944, 5 and 27 percent, respectively, whereas in babbitt it declined to 12 percent against 14 percent in 1944.

INVESTIGATION OF DOMESTIC TIN DEPOSITS

Field studies of tin occurrences were continued in 1945. The Bureau of Mines and the Geological Survey, as a part of their strategic mineral exploration programs, investigated deposits in Alaska and California. A lode deposit of tin on the Seward Peninsula of Alaska, which promises greater potentialities than any other known domestic source of tin, was tested by diamond drilling, and another deposit was explored in California. The Bureau of Mines has made a general survey of tin in California in which 37 places were visited and sampled. The survey purposed to investigate all reported tin occurrences and was not confined to the few deposits claimed to be commercial but extended to any that might yield substantial tonnages under pressure of necessity that made cost unimportant. The authors [4] in their report on the survey state:

> Although traces of tin were found in many places, nothing that suggested a tin mine was found anywhere, and it is difficult to base much hope for appreciable future tin production upon anything found thus far in California.

Page and Thayer, and Wiese and Page, of the Geological Survey, made geological reports accompanied by numerous maps of the Temescal and Gorman tin districts, California.[5]

The tin deposits of Riverside County, Calif., including the Temescal tin mine (Cajalco) owned by Tinco Corp., Richmond, have been described by Tucker and Sampson.[6]

In 1942 the Dodge Construction Co., Fallon, Nev., operating under lease from the owner, secured a Government loan for the purpose of working the Temescal tin mine. After a net expenditure of $125,000 by the Government, the project was abandoned as unsuccessful. A modern 100-ton mill was erected, and 1,400 tons of material were put through it, with a recovery of less than 1 pound of tin oxide per ton.

DOMESTIC PRODUCTION

MINE OUTPUT

The expectation that tin may be mined commercially—if at all—in the United States may well be dismissed. The Bureau of Mines received no reports of production in 1945. Results of recent organized investigations have been recited above, and preceding chapters of

[4] Bedford, R. H., and Johnson, F. T., Survey of Tin in California: Bureau of Mines Rept. of Investigations 3876, 1946, 14 pp.

[5] Page, L. R., and Thayer, T. P., Preliminary Report on the Temescal Tin Deposits of Riverside County, Calif. Wiese, J. H., and Page, L. R., Final Report on Tin Deposits of the Gorman District, Kern Co., Calif. These reports were not published but placed in open file. They may be consulted at the Geological Survey library, Washington, D. C., at its regional office, Salt Lake City, Utah, and at the office of the California Division of Mines, San Francisco.

[6] Tucker, W. B., and Sampson, R. J., Mineral Resources of Riverside County: State of California Dept. of Natural Resources, Division of Mines, California, Jour. Mines and Geology, vol. 41, No. 3, July 1945, pp. 151–154.

this series have described for 60 years or more various well-planned and misdirected efforts to find tin. The total yield has not exceeded a few hundred tons of tin—not enough to supply the country's needs for a month, even at the extremely low level of use set up in 1943.

Mine production of tin (content) in the United States, 1941–45, by States

Year	Long tons				Value
	Alaska	South Dakota	Other States [1]	Total	
1941	46.8	1.4	8.1	56.3	$65,600
1942	2.8	1.4	2.1	6.3	7,300
1943	.1	.6	5.2	5.9	6,800
1944		(2)	(2)	5.4	6,200
1945					

[1] 1941: Alabama, Montana, and New Mexico; 1942: Alabama, California, Nevada, and New Mexico; 1943: California, Nevada, and New Mexico; 1944: California, New Mexico, North Carolina, and South Dakota.
[2] Included in total.

SMELTER OUTPUT

Domestic tin smelters produced 40,475 long tons of tin in 1945, a peak two and a half times that recorded during World War I. This was accomplished almost wholly by the Government's Longhorn tin smelter, where output was one-third greater than in 1944. Its production rose uninterruptedly from September 1944 through July 1945 and then after 2 months continued to set new monthly records. In December it operated at a 44,000-ton annual rate and was closely approaching the program set for 1946. It thus became the world's largest single operating smelter. Maintenance of the rate of output will depend largely on the timing of receipts of high-grade material, which of late, however, has constituted only 10 to 15 percent of the charge.

Improvement in operating efficiency was noted during the year. Two reverberatories were converted into one unit. Results were as satisfactory as could be expected, giving consideration to limitations placed on design by existing construction. Among other plant betterments were the replacement of a tubular by a water-tube waste-heat boiler, which had not been procurable earlier; continuous mechanical dust removal from the main roaster flue; and improvements to the Cottrell plant. In keeping with the general industrial pattern, the work week was cut to 40 hours and pay ratio increased 18 percent in the fall. Processing costs have not been disclosed, but it has been said that on high-grade material originally treated they averaged about 2.3 cents a pound and rarely reached 3.5 cents. In the nearly 4 years of operation, the cost of labor and supplies rose greatly, while the grade and quality of ore treated declined heavily. In consequence, treatment costs have been estimated to be as much as 6.5 cents. The rise in operating expenses plus the difference between the ore costs and fixed ceiling selling price of metal indicate that the over-all Government tin operations were subsidized in 1945 to the extent of about $12,000,000.

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Shipments by the Longhorn smelter were 39,974 long tons (37,112 in 1944), of which 37,495 tons (32,856 in 1944) were Three Star and the remainder Grade F. Industrial users received about 25,733 tons, and the remainder was distributed to Government warehouses in Brooklyn, Chicago, St. Louis, and Texas City and to brokers or jobbers.

Only two privately owned smelters were in operation in 1945—the American Smelting & Refining Co. and the Vulcan Detinning Co.

SECONDARY TIN

Renewed efforts to bring out scrap, especially lead-base, that was acutely short, although tin-base was not neglected, resulted in an 8-percent rise in total secondary tin recovered in 1945. Detinners' recovery showed a net slight decrease. Corresponding to the greater tin-plate output, tin obtained from new clippings was up 10 percent over 1944 (2,375 long tons). The effect of the increasing component of electrolytic plate was again observed in a 13-percent rise in the tonnage treated. Tin recovered from old cans was 26 percent (about 340 tons) below that in 1944. At no time could the salvage campaign be counted a great success, and notwithstanding the deterioration in the tin-supply position it broke down seriously after termination of the war appeared imminent. In the more effective 3 years 1943–45 the recovery was about 4,000 tons annually or less than 5 percent of the total secondary tin produced. It is worthy of comment that, in the last 2 years at least, the Army, from its various camps and posts, supplied more than one-quarter of the gross weight of prepared cans returned and more than that of the tin recoverable therefrom.

Secondary tin recovered in the United States, 1925–29 (average) and 1941–45

Year	Tin recovered at detinning plants			Tin recovered from all sources			
	As metal (long tons)	In chemicals (long tons)	Total (long tons)	As metal (long tons)	In alloys and chemicals (long tons)	Total: Long tons	Total: Value
1925–29 (average)	900	2,000	2,900	7,500	23,100	30,600	$38,034,120
1941	4,500	950	5,450	5,300	32,200	37,500	43,722,700
1942	4,700	200	4,900	5,200	28,700	33,900	39,434,720
1943	3,900	200	4,100	4,700	29,100	33,800	39,332,800
1944	3,350	310	3,660	3,800	25,300	29,100	33,892,560
1945	3,150	400	3,550	3,300	28,100	31,400	36,538,320

The Government-owned detinning plant at Birmingham, Ala., continued to operate, but, as heretofore, most of the tin was recovered at privately owned plants. The 1944 chapter of this series was in error in reporting complete discontinuance of other metal-recovery operations. In 1944 the National Lead Co., as agent of the Metals Reserve Company, recovered nearly 100 long tons of tin (revised) from type metal and in 1945, 10 tons. The total auxiliary recovery through 1945 from collapsible tubes and type metal was 1,165 long tons, most of which reappeared in alloy form. The chapter in this volume, Secondary Metals—Nonferrous, contains details on secondary tin recovery.

CONSUMPTION

APPARENT CONSUMPTION

In 1945 the apparent consumption of primary tin was 11 percent higher than in 1944. Apparent consumption is computed by adding domestic smelter production to net imports. It does not take into account fluctuations in consumer, dealer, and Government stocks; consequently, it may deviate widely from actual consumption as measured in finished products, which in 1945 was 16 percent above the calculated figure. Nevertheless, the apparent consumption series is useful as an indicator of long-term trend. The data for 1939–45 are given in the subjoined table.

Apparent consumption of tin, 1939–45, in long tons [1]

1939	67, 997
1940	123, 537
1941	141, 618
1942	42, 512
1943	31, 749
1944	43, 379
1945	48, 033

[1] The series 1910–38 was published in Minerals Yearbook, 1939, p. 680. Exports of domestic tin are not included in 1931–41, inclusive. They are included in the figures for 1942–45 and are 244, 398, 405, and 708, respectively.

CONSUMPTION BY USES

Military successes, that had restored much of the freedom of the seas by the end of 1944, and the defeat of Germany, and unexpectedly early surrender of Japan in 1945 left their imprint on the use pattern of tin. Usual prewar relationships were, however, not fully in evidence. The accompanying tables, prepared from reports made to the Bureau of Mines, show actual consumption of primary and secondary tin, both where it entered process and left as finished products.

Consumption of primary and secondary tin in the United States, 1941–45, in long tons

	1941	1942	1943	1944	1945
Stocks on hand Jan. 1	56, 999	[1] 67, 421	[2] 43, 853	[3] 34, 735	[4] 27, 391
Net receipts during year [5]	149, 123	65, 568	75, 101	86, 970	86, 096
Available supply	206, 122	132, 989	118, 954	121, 705	113, 487
Stocks on hand Dec. 31	[1] 67, 421	[2] 43, 853	[3] 34, 735	[4] 27, 391	[6] 25, 789
Total processed during year	138, 701	89, 136	84, 219	94, 314	87, 698
Intercompany transactions in scrap (tin content)	2, 936	2, 547	2, 889	3, 205	3, 239
Total consumed in manufacturing	135, 765	86, 589	81, 330	91, 109	84, 459
Plant losses	1, 070	902	1, 000	1, 140	876
Tin content of manufactured products	134, 695	85, 687	80, 330	89, 969	83, 583
Primary	[7] 103, 086	56, 288	46, 253	59, 156	55, 642
Secondary	31, 609	29, 399	34, 077	30, 813	27, 941

[1] Not including 2,700 tons in transit or in warehouses.
[2] Not including 78 tons in transit.
[3] Not including 316 tons in transit or in warehouses.
[4] Not including 1,941 tons in transit or in warehouses.
[5] 1941: Primary, 114,281; secondary, 6,879; terne, 1,851; scrap, 26,112. 1942: Primary, 33,126; secondary, 5,096; terne, 405; scrap, 26,941. 1943: Primary, 40,548; secondary, 4,462; terne, 188; scrap, 29,903. 1944: Primary, 55,323; secondary, 2,536; terne, 228; scrap, 28,883. 1945: Primary, 54,663; secondary, 2,623; terne, 312; scrap, 28,498.
[6] Not including 1,600 tons in transit or in warehouses.
[7] Includes small tonnage of secondary pig tin.

Continued application of conservation measures and shift in emphasis from production of war materials to those of peace resulted in 7 percent lower total consumption than in 1944, with the quantitative change shared nearly equally between primary and secondary tin. The ratio of the primary to total secondary tin, 2 : 1, compared with a 4 : 1 ratio in 1935–39, a rather striking evidence of what may be accomplished in tin conservation. As has been the case for many years, tin plate (and terneplate) holds the premier position as a user of virgin tin, taking 47 percent of the new metal. The increase of 1,100 tons or 4 percent compared with 1944 and 20 percent over the 10-year low of 1943 reflected the rise in tin-plate output as modified by the large electrolytic component. In second place was solder, up 24 percent over 1944, which accounted for nearly 20 percent of the virgin tin used and was at the 1935–39 average. In part, the large increase was due to the dearth of secondary material, permissible upgrading in tin content, and release of tin for automobile-body solders. The most-pronounced change was the drop of nearly 4,700 tons, or one-third, in the requirements for bronze. Consumption for babbitt was off about 28 percent compared with 1944, but the quantity used was close to the prewar (1935–39) and wartime (1942–45) averages. Other uses of virgin metal accounted for about 9 percent, of which nearly half was for tinning.

Consumption of tin in the United States, 1943–45, by finished products (tin content), in long tons

Product	1943			1944			1945		
	Primary	Secondary	Total	Primary	Secondary	Total	Primary	Secondary	Total
Tin plate	21,684	42	21,726	24,968		24,968	26,080		26,080
Terneplate	100	334	434	510	230	740	493	248	741
Solder	5,292	7,384	12,676	8,786	4,841	13,627	10,930	3,399	14,329
Babbitt	3,217	4,536	7,753	5,790	2,996	8,786	4,144	3,684	7,828
Bronze and brass	11,180	18,575	29,755	13,768	19,327	33,095	9,093	17,972	27,065
Collapsible tubes	282	309	591	283	242	525	515	44	559
Tinning	2,690	324	3,014	2,771	370	3,141	2,390	202	2,592
Foil	227	145	372	226	92	318	181	64	245
Chemicals	112	299	411	34	259	293	[1] 196	[1] 448	[1] 644
Pipe and tubing	82	118	200	230	32	262	204	89	293
Type metal	28	1,053	1,081	49	1,302	1,351	10	1,281	1,291
Galvanizing	4		4						
Bar tin	685	276	961	1,092	167	1,259	963	131	1,094
Miscellaneous alloys	360	566	926	417	707	1,124	378	228	606
White metal	90	[2] 55	[2] 145	19	86	105	65	151	216
Miscellaneous	220	61	281	213	162	375	(3)	(3)	(3)
	46,253	34,077	80,330	59,156	30,813	89,969	55,642	27,941	83,583

[1] Includes "Miscellaneous."
[2] Includes 5 tons of secondary for pewter.
[3] Included under "Chemicals."

In respect to the consumption of primary plus secondary tin, there was no change in order of rank compared with 1944. For the third consecutive year, bronze held first place, but by only a narrow margin over tin and terneplate. The expansion of the ship-building program that began in 1939 reached its peak in 1944. The effect of naval construction on tin needs was apparent. According to reports made to the Bureau of Mines, production of tin bronzes—that is, the five principal types having 5 percent tin or over—rose from 187,000 short tons in 1941 to 340,000 tons in 1944 and then dropped about one-quarter to 259,000 tons in 1945. In this period the ratio of output of these bronzes to total bronze and brass ingot production was fairly stable at from 62 to 68 percent. Quantitatively, however, the tin content of the bronzes varied essentially with the production, but relatively it rose from about 48 percent of the total in bronze and brass to more than 65 percent and receded in 1945 to about 58 percent. In view of the tremendous tonnage demands for bronze, it is apparent that the secondary supply usually available would be inadequate. Consequently much new metal was required, and a large part will sooner or later return as scrap, tending to cut primary tin needs even below the prewar level for bronze. The downward movement in babbitt was in response to the sharp year-end cut-back in production of white-base antifriction bearing metals.

FOREIGN TRADE [7]

Pig tin has ceased to dominate the import field since 1943, when the United States was denied access to former Asiatic sources. Previous procurement agreements abroad permitted suppliers to divert part of their shipments after VE-day from the United States to western European and other countries, while large quantities of ores were afloat or stored abroad; consequently, imports of metallic tin decreased 37 percent and ores 6 percent from 1944 levels. Metallic tin (882 tons) acquired by the Army from Germany and the Philippines and imported in 1945 has not been included. The Longhorn smelter, Texas City, Tex., was the destination of virtually all tin concentrates imported in 1945. The tin content of the material imported was 33,527 tons (35,548 in 1944). Bolivia continued to be the principal source, supplying 25,984 tons, compared with 27,701 in 1944. Imports from other sources included: Belgian Congo, 7,401 tons (7,549 in 1944); French Africa, 129 (177 in 1944); Mexico, 13 (61 in 1944); and Argentina, none in 1945 (60 in 1944).

Foreign trade of the United States in tin and tin concentrates, 1941–45

Year	Imports				Exports of tin (metal)[1] (long tons)
	Tin (metal)		Tin concentrates (tin content)		
	Long tons	Value	Long tons	Value	
1941	140,873	$149,569,328	28,670	$27,671,689	1,094
1942	26,753	29,311,113	28,933	21,422,896	[2] 165
1943	12,030	13,089,540	21,857	24,804,842	[2] 1,372
1944	13,338	15,049,200	35,548	32,346,412	[2] 438
1945	8,440	9,163,425	33,527	27,262,436	[2] 174

[1] Imported as pigs, bars, etc., and exported as such.
[2] In addition 244 tons of ingots, pigs, etc., were exported in 1942, 398 tons in 1943, 405 tons in 1944, and 708 tons in 1945; accounted for as domestic exports in "Exports of miscellaneous tin manufactures."

[7] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Tin [1] imported for consumption in the United States, 1944–45, by countries

Country	1944		1945	
	Long tons	Value	Long tons	Value
Belgian Congo	10,000	$11,199,813	6,494	$6,853,883
British Malaya	(2)	110		
Canada	(2)	13		
China	3,338	3,849,251	1,946	2,309,542
United Kingdom	(2)	13		
	13,338	15,049,200	8,440	9,163,425

[1] Bars, blocks, pigs, grain, or granulated.
[2] Less than 1 ton.

Foreign trade in tin plate, taggers tin, and terneplate in various forms, 1941–45, in long tons

Year	Tin-plate scrap		Tin-plate circles, strips, cobbles, etc. (exports)	Waste-waste tin plate (exports)	Terneplate clippings and scrap (exports)	Tin plate, taggers tin, and terneplate	
	Imports	Exports				Imports	Exports
1941	22,600	180	4,952	8,321	751	109	354,940
1942	24,082		1,333	3,230	76	134	593,776
1943	19,591	27	1,607	50	56	101	396,550
1944	17,323	112	1,294	3,103	161	112	436,632
1945	18,072	433	1,684	12,215	378	144	471,149

Foreign trade in miscellaneous tin manufactures and tin compounds, 1941–45

Year	Miscellaneous tin manufactures		Tin compounds (pounds)	
	Imports [1]	Exports [2]	Imports	Exports
1941	$2,266	$1,456,353	7,224	137,424
1942	[3] 949	591,937		117,191
1943	[3] 2,425	666,476		25,042
1944	[3] 3,682	1,143,006		25,992
1945	[3] 1,403	1,344,477	25	35,107

[1] Includes tin manufactures, n. s. p. f., tinfoil, tin powder, flitters, and metallics.
[2] Includes tin dross and tin-bearing scrap material other than tin-plate scrap.
[3] In addition, 505,346 pounds of tin dross, skimmings, and residues valued at $63,978 were imported in 1942, 45,943 pounds valued at $4,595 in 1943, 108,296 pounds valued at $9,536 in 1944, and 127,680 pounds valued at $29 in 1945.

Exports of tin plate, terneplate, and taggers tin increased 8 percent in 1945, with substantial shipments to Europe. The principal destinations were Latin America (29 percent), Australia and New Zealand (23 percent), Canada (13 percent), and Europe (13 percent); shipments to the first two declined 1 and 19 percent, respectively, compared with 1944, whereas for the last two they rose 64 and 617 percent. Exports to Africa (10 percent of total) increased 29 percent; those to Russia (8 percent) decreased 22 percent; and those to miscellaneous countries (4 percent) were off 38 percent.

By amendment of the War Production Board Import Control Order, M–63, on November 30, 1945, importation of tin alloys (including alloy scrap) and tin bars, blocks, pig, grain, and granulated were again put under control when tin alloys were being offered in this country by foreign sellers at prices above the 52 cents a pound ceiling on tin content.

Tin plate, terneplate (including long ternes), and taggers tin exported from the United States, 1944–45, by principal countries

Country	1944		1945	
	Long tons	Value	Long tons	Value
Africa:				
British:				
Anglo-Egyptian Sudan	201	$18,581	1,438	$143,557
British East Africa	1,812	182,933	2,135	211,593
Mauritius and Dependencies	1,921	195,686	136	17,344
Southern Rhodesia	280	32,498	752	86,310
Union of South Africa	27,818	3,644,573	36,688	4,168,597
Algeria	779	94,064	763	90,847
Argentina	34,490	4,160,362	29,392	3,734,548
Australia	119,212	14,283,304	98,623	11,887,721
Belgium and Luxembourg			5,849	684,445
Brazil	52,262	6,377,372	50,344	5,723,732
Canada	36,796	3,880,159	60,445	6,636,345
Ceylon	718	95,601	359	51,700
Chile	3,917	464,674	6,231	744,787
Colombia	841	107,614	2,048	262,544
Cuba	10,902	1,379,511	11,307	1,433,448
Egypt	926	93,134	1,984	184,445
France			18,839	2,347,500
India and dependencies	30,858	3,332,626	4,708	574,798
Iran			7,407	726,057
Madagascar	2,440	283,517	827	93,000
Mexico	14,195	1,736,427	13,619	1,628,460
Morocco, French	3,304	395,699	3,860	459,413
Netherlands			14,133	1,708,184
New Zealand	13,893	1,650,385	9,177	1,063,777
Palestine and Trans-Jordan			469	46,290
Paraguay	1,622	194,452	1,815	212,436
Peru	1,515	416,623	2,594	298,332
Portugal	8,035	988,862	15,350	1,843,732
Spain			1,715	218,620
Sweden			2,937	380,224
Switzerland			545	67,759
Syria	600	57,379	1,278	125,668
Turkey	3,051	284,738	5,600	597,404
U. S. S. R	45,681	5,514,567	35,568	4,311,552
United Kingdom	344	40,354	714	86,924
Uruguay	15,146	1,948,690	14,679	1,812,313
Venezuela	1,362	177,511	2,936	379,648
Other countries	1,711	273,842	3,885	468,941
	436,632	52,305,738	471,149	55,512,995

PRICES

The price of tin remained stabilized in the United States at established Government ceilings throughout 1945. The price of pig tin exported by Office of Metals Reserve was exempted from price control, effective December 31, 1945, by amendment 2 to Office of Price Administration Maximum Price Regulation 17. Metals Reserve announced on March 4, 1946, that, beginning with its March allocations, the price of pig tin for export was advanced 6 cents per pound, making Grade A brands 58 cents per pound in lots of 5 tons or more for delivery ex-dock or warehouse at United States port, or f. o. b. smelter at Texas City. In September 1945 the British export price was raised £75 above the pegged domestic price of £300, but effective

April 1, 1946, was reduced to £357. The maximum prices, by grades and brands, during 1945 were as follows:

Grade A. 99.80% or higher, meeting specifications set forth in M. P. R. No. 17 ---- 52.00c.
Following brands of pig tin will be considered as qualifying as Grade A: Longhorn 3-Star, Chempur, Pyrmont, Straits Trading, O. T. Lempriere & Co., E. S. Coy (Penang), Billiton, Mellanear (Guar. 99.9%), Hawthorne Refined, Banka, Union Min. du H. Katanga, M and T No. 1, M and T Electrolytic Refined, Vulcan American Refined, Vulcan Electrolytic, Pass No. 1.
Grade B. 99.80% or higher, not meeting specifications for Grade A, providing arsenic content does not exceed 0.05% ---- 51.87½c.
Grade C. 99.65% to 99.79% and 99.80% or higher, not meeting specifications for Grade A or Grade B ---- 51.62½c.
Grade D. 99.50% to 99.64% (includes Longhorn 2-Star) ---- 51.50c.
Grade E. 99.00% to 99.49% (includes Longhorn 1-Star) ---- 51.12½c.
Grade F. Below 99% pure (for tin content) (includes Longhorn No-Star) ---- 51.00c.

Tin price data, 1925–29 (average) and 1941–45

	1925–29 (average)	1941	1942	1943	1944	1945
Average prices:						
New York: [1]						
Straits tin ---- cents per pound	56.64	52.01	[2] 52.00	[2] 52.00	[2] 52.00	[2] 52.00
99.75-percent tin (English refined) cents per pound	(3)	(4)	[5] 51.625	[5] 51.625	[5] 51.625	[5] 51.625
99-percent tin ---- do	55.50	51.26	[6] 51.125	[6] 51.125	[6] 51.125	[6] 51.125
London: [7]						
Standard tin ---- £ per long ton	254.6	[8] 261.6	[9] 275.0	[9] 275.0	[9] 300.0	[9] 300.0
Do ---- cents [10] per pound	55.17	[11] 47.09	49.54	49.54	54.04	[12] 54.04
Premium allowed over standard:						
Straits ---- £ per long ton	5.1	(3)	(3)	(3)	(3)	(3)
Banka ---- do	6.9	(3)	(3)	(3)	(3)	(3)
English ---- do	–.7	(3)	(3)	(3)	(3)	(3)
Price indexes (1925–29 average=100):						
Straits tin (New York)	100	92	92	92	92	92
Copper (New York)	100	80	80	80	80	80
Lead (New York)	100	78	87	87	87	87
Nonferrous metals [13]	100	85	87	87	87	87
All commodities [13]	100	89	101	105	106	108

[1] American Metal Market.
[2] Maximum for Grade A, 99.8 percent or higher (includes Straits).
[3] Data not available.
[4] January–August, nominal; September–December, 51.62 cents.
[5] Maximum for Grade B, 99.75–99.79 percent, and Grade C, Cornish refined.
[6] Maximum for Grade D, 99.0–99.74 percent.
[7] Metal Bulletin, London, as compiled by International Tin Research and Development Council.
[8] 11-month average.
[9] British Government maximum price.
[10] Conversion of British quotations into American money based upon average rates of exchange recorded by the Federal Reserve Board of the Treasury.
[11] Based upon free exchange rate.
[12] Official rate; free rate, 53.98.
[13] Based upon price indexes of U. S. Department of Labor.

Free market prices for tin ceased to exist about the end of 1941. What might be termed the basic London and New York prices were fixed by Government decree close to the figure that ruled at that time. Although the usual price differential was increased in 1942–43, it was reversed almost the same amount in 1944–45 by the £25-a-ton increase in the internal British price, while no change was made in the American price. Outside these countries, the prices of tin, as metal or in concentrate, showed marked disparity. Recently reported prices have been: Belgian Congo and Bolivia about £350, Nigeria £300, Union of South Africa £422, Australia £A231 for 70-percent concentrate delivered Sydney. In Belgium it was 64,000 francs and in France 84,000 francs a metric ton. In 1945 Portugal and Spain set prices that, at official rates of exchange were, respectively about $2.31 and $3.31 a pound. These prices are not of moment, since the supply is inconsequential and the movement beyond the countries was limited by edict. They may, however, represent black market prices. An attempt at stabilization at an economic level in the light of war-induced increased costs of production was noted near the year end in the setting of a £300 price for Malayan tin and a repeated offer to Nigerian producers at the same figure, which is close to that to be paid Bolivian producers in the second quarter of 1946.

STOCKS

Total year-end stocks of primary tin plus tin content of the ore and concentrates in the United States in 1945 were 83,525 tons, 17 percent below those of 1944. In addition, 11,391 tons (about 1,300 tons more than in 1944) were in process in scrap and as secondary pig tin. Of the tin and concentrates, the Government held 81 percent (including sterilized stocks of 12,140 long tons of metal) and private owners the remainder. The quantity (in terms of tin content) held by the Government was divided about equally between metal and ores and concentrates. Government stocks of pig tin were depleted 12 percent and industrial stocks 17 percent. Virtually all industrial stocks were in the form of metal; only a small quantity was in ores awaiting treatment at privately owned plants. These stocks were at the lowest point since the depression of the 1930's and were about 3 months' requirements at the proposed 1946 use rate. The quantity of tin and concentrates on hand was equivalent to about 1.5 years' supply at the rate of consumption in 1945, or about 1.25 years at the proposed 1946 use rate.

Stocks of virgin pig tin in the United States, Dec. 31, 1941–45, in long tons

	1941	1942	1943	1944	1945
Location of stocks:					
Afloat to United States [1]	[2] 15,000	[2] 900	[2] 1,650	[2] 1,800	
At landings in New York [1]	3,129	(3)	(3)	(3)	(3)
In licensed warehouses in New York [1]	371				
Total visible supply [1]	18,500	[2] 900	[2] 1,650	[2] 1,800	
Consumers' stocks [4]	[5] 56,922	[6] 31,226	[7] 23,227	[8] 19,325	[9] 15,771
Total stocks on hand	[10] 75,422	[10] 32,126	[10] 24,877	[10] 21,125	[10] 15,771

[1] As reported by Commodity Exchange, Inc.
[2] Estimated.
[3] Not available.
[4] As reported to the Bureau of Mines; do not include tin in process or secondary pig tin.
[5] Includes 2,700 tons in transit in the United States and at other warehouses not contained in figures above for "at landings" and "in licensed warehouses."
[6] Includes 78 tons in transit and 84 tons held by jobbers.
[7] Includes 316 tons in transit and at other warehouses and 50 tons held by jobbers.
[8] Includes 1,941 tons in transit and at other warehouses and 47 tons held by jobbers.
[9] Includes 1,600 tons in transit and at other warehouses and 69 tons held by jobbers.
[10] Exclusive of Government purchases delivered for stock-piling or at Texas City smelter.

The Bureau of Mines canvassed tin consumers to determine stocks and use during 1945. According to these reports, the consuming industry had 14,102 tons of primary pig tin at plants at the end of 1945, including 6,315 tons held by tin-plate manufacturers. The industry also had 1,600 tons of primary tin in transit or warehoused, in addition to 358 tons of secondary pig tin on hand at the end of the year.

WORLD ASPECTS OF THE TIN INDUSTRY

INTERNATIONAL CONTROLS

Since the beginning of the Japanese phase of World War II the International Tin Committee (ITC) has had virtually no reason for existence, nor in many minds is there justification for its continuance. Certainly, in view of the supply-demand unbalance that is likely to persist for 2 or 3 years, there is no need for production (export) control. The 5-year extension of the third control agreement that expires at the end of 1946 preserved the machinery of control and makes its further extension possible. Pursuant to the requirement that a recommendation for continuance be made not less than 12 months before the expiration date, preliminary discussions were said to have been held in London in the fall of 1945. In March 1946 the committee held a scheduled meeting to put the recommendations in final form. The recommendations are not yet known, as the committee stated, "As this recommendation is confidential to the Governments, parties to the agreement, no announcements of its contents can be made." The Mining Journal (London) of March 16, 1946, observed that "It was understood it was decided to recommend the continuance beyond the end of the current year." It is also believed that consideration was given to the readmittance of Siam and Indochina. During the period of inaction the ITC has continued to support research activities directed mainly to finding new or expanded uses for tin. No consequential developments have been reported. In February 1946 the Hague office of the International Tin Research and Development Council resumed publication of statistical bulletins.

In the place of production control, it became imperative after 1941 to parcel out existent and new supplies of tin and other commodities. This was undertaken for the Allied Nations by the Combined Raw Materials Board, which was under British and American Government auspices and was seated in Washington. This group ceased to function at the end of 1945. Without interruption the distribution of tin (metal only) to claimants, including limited quantities for vanquished countries, was carried on by its successor, the Combined Tin Committee. Belgium, France, and the Netherlands, as well as the United Kingdom and the United States, participate in the committee. About the end of the year interim allocations were made, and in March 1946 modified allocations were made for the first half of 1946. Therein the United States share was about three-eighths of the 18,300-ton total, or somewhat below the usual percentage taken by the United States, probably resulting from distribution to wartime, tin-starved nations.

Opposition to the revival of international commodity agreements typified by ITC was strengthened in 1945. At the meeting at sea of

President Roosevelt and Prime Minister Churchill in August 1941 a mutual-aid agreement was reached on measures providing for safety against the attacks of Germany and its associates. At the same time, the principles later known as the Atlantic Charter were enunciated and subscribed to by the United Kingdom and the United States. These principles were set up not only for the conduct of the war but to extend beyond the destruction of Axis power. As an adjunct thereto were expressed the hopes for freer trade—freedom of access to raw materials—and international cooperation in the economic field. In January 1943 was formed a loose aggregation of 26 nations, the United Nations Organization that in 1945 became the actively functioning United Nations. Presumably as one result of the Atlantic Charter understandings, the British Government stated late in 1942 that the tin-restriction scheme, like other commodity-regulation schemes, would be subject to postwar review. The American policy, which has the support of the British Government, has been set forth by the United States Department of State,[8] proposing the formation of an International Trade Organization, and a conference thereon by the United Nations has been requested by the summer of 1946. A major barrier to expansion of world trade is the "restrictions imposed by private combines and cartels." The proposals contemplate that countries will act individually and collectively to curb their restrictive practices. In place of international commodity arrangements, intergovernmental commodity agreements would be made under specified conditions. Membership would be open to any country, but it was especially recommended that consuming countries lacking the materials in question should have an equal voice with producing countries in consideration of any agreements as well as in their administration. Agreements should also operate to assure availability of supplies adequate at all times for world needs at reasonable prices, and requirements should be met from sources that can supply them most effectively. It was recognized that problems of trade in primary commodities differed from those connected with manufactured goods and might be serious. In respect to raw materials, intergovernmental action would be preceded by special studies in those cases where "excess supplies exist or are threatened"; where widespread unemployment has developed or is developing, and these conditions "cannot be corrected by the normal play of executive forces." The various provisions are not to apply however to effectuate "an equitable distribution of commodities in short supply." The conference should create an Industrial and Mineral Unit that "should promote by technical assistance, and other appropriate means the expansion of production and trade * * * with regard to minerals and other primary commodities" that are not under the jurisdiction of the Food and Agriculture Organization. Insofar as tin is concerned, it is likely to remain in the "short supply" class for a brief period, in which instance the Combined Tin Committee may continue to function. If that condition were to persist, the Industrial and Mineral Unit might take a hand. In any case the ITC would have a sharply constricted field in which to operate.

[8] U. S. Dept. of State, Proposals for Expansion of World Trade and Employment: Pub. 2411, Commercial Policy Series 79, November 1945, 28 pp.

WORLD MINE PRODUCTION

Official reports for the war period received by the Bureau of Mines and the resumption of statistical reporting by the International Tin Research and Development Council permitted revision of the production figures heretofore tentatively presented. With the exception of 1 year, 1943, the estimates agreed closely with figures presented in the accompanying table. The wide divergence in that year was due to an underestimate of Netherlands East Indies that now is given authoritatively at 15,133 tons.

Final figures for 1945 were not fully available when this chapter was prepared, but the total was probably close to 87,000 tons or near the low point of this century. Findings of various investigational groups point to an increase of only about 20,000 to 25,000 tons in 1946, with full-scale output in 1948.

World mine production of tin (content of ore), 1925–29 (average) and 1939–45, by countries, in long tons

[Compiled by B. B. Waldbauer]

Country	1925–29 (average)	1939	1940	1941	1942	1943	1944	1945
Restricted production:								
Belgian Congo	967	8,964	12,482	16,190	16,191	17,480	17,326	17,077
Bolivia (exports)	37,169	27,211	37,940	42,199	38,293	40,312	38,720	42,487
Indochina	691	1,470	1,472	[1] 1,430	[1] 1,400	[1] 1,000	[1] 500	[1] 200
Malay States:								
Federated	54,606	49,525	85,384	[1] 78,000	[1] 15,000	[1] 15,000	[1] 10,000	[1] 2,000
Unfederated	2,206	1,994						
Straits Settlements	25	206						
Netherlands Indies	33,266	27,755	43,193	[1] 51,000	[1] 10,000	15,133	6,069	843
Nigeria	8,319	9,427	12,012	[1] 15,000	[1] 12,500	12,654	12,500	[1] 11,500
Siam (Thailand)	8,204	[2] 17,325	17,447	[1] 16,250	[1] 12,000	[1] 7,000	[1] 5,000	[1] 3,000
Total signatory countries	145,453	143,877	209,930	220,000	105,000	109,000	[1] 91,000	[1] 78,000
Unrestricted production:								
Argentina	32	1,655	1,481	921	998	[1] 700	792	[1] 545
Australia	2,830	3,067	3,501	3,494	2,931	2,635	2,540	[1] 2,500
Burma	2,228	8,536	[1] 5,500	(3)	(3)	[1] 1,000	[1] 500	[1] 200
Cameroun, French	-------	243	218	220	233	194	161	112
Canada	-------	-------	-------	29	553	347	231	379
China	[2] 7,085	[2] 10,422	[2] 6,249	[1] 8,000	[1] 7,000	[1] 5,000	[1] 3,000	[1] 1,500
Germany [4]	98	285	293	303	547	[1] 980	[1] 980	(3)
Italy	-------	256	309	230	200	(3)	(3)	(3)
Japan	625	[1] 1,700	(3)	(3)	(3)	(3)	(3)	(3)
Mexico	2	289	345	212	365	426	317	174
Morocco, French	4	31	20	26	4	11	9	(3)
Peru	-------	47	72	47	75	69	-------	123
Portugal	625	1,486	1,721	2,330	2,670	3,460	[1] 1,800	[1] 600
Portuguese East Africa	5	7	6	4	10	6	8	[1] 5
Rhodesia:								
Northern	-------	-------	16	10	2	3	6	[1] 5
Southern	15	451	450	231	162	178	123	125
South-West Africa	149	156	137	120	110	158	122	180
Spain	145	106	100	103	239	222	483	[1] 530
Swaziland	138	114	103	131	113	109	77	53
Tanganyika (exports)	22	224	258	247	193	159	124	137
Uganda (exports)	98	354	334	302	283	296	288	215
Union of South Africa	1,174	482	518	463	508	526	506	[1] 500
United Kingdom	2,658	1,633	1,620	1,509	1,363	1,359	1,289	[1] 993
United States	24	34	49	56	6	6	5	-------
Total nonsignatory countries	17,957	31,578	26,070	20,000	20,000	18,000	14,000	9,000
Grand total	163,000	176,000	236,000	240,000	125,000	127,000	105,000	87,000

[1] Estimates by the authors.
[2] Exports.
[3] Estimate included in total.
[4] Data include Sudetenland.

WORLD SMELTER PRODUCTION

The table below offers estimates of the world's smelter production, 1939–45. The United States probably held first place, followed by the United Kingdom and the Belgian Congo. Continental output approached the vanishing point in 1944–45, and in the Far East reports of an American investigator indicate that production was at an extremely low ebb.

Although damaged extensively, mostly by removal of equipment, the Billiton Co.'s modern smelter at Arnhem, Netherlands, is expected to resume work on a limited scale in 1946. Belgian smelters were repaired and furnished a small output in 1945. The Allied Control Council for Germany approved the annual use of 8,000 tons of tin; whether Germany may undertake smelting and refining was not stated. Contrary to expectations, Far Eastern smelters were not seriously damaged on the whole and can be put in operating shape well in advance of large receipts of ores. Almost all the Siamese mine output was smelted at Penang, but during the Japanese occupation 18 native smelters were erected and operated. Siam has thus become self-sufficient in smelting capacity.

World smelter production of tin, 1925–29 (average) and 1939–45, by countries, in long tons

[Compiled by B. B. Waldbauer]

Country	1925–29 (average)	1939	1940	1941	1942	1943	1944	1945
Argentina	-------	1,080	881	768	709	552	[1] 500	[1] 500
Australia	2,952	3,294	3,544	3,656	3,024	2,565	2,442	[1] 2,400
Belgian Congo	-------	2,124	7,832	11,818	13,963	11,068	10,000	[1] 10,000
Belgium [1]	720	[2] 3,100	(3)	(3)	(3)	(3)	(3)	[1] 500
British Malaya	[4] 88,855	[4] 81,536	[2] 126,945	[1] 125,000	[1] 10,000	[1] 15,000	[1] 5,000	[1] 2,500
Canada	-------	-------	-------	29	553	347	231	379
China	[5] 7,080	10,850	[1] 13,000	[1] 10,000	[6] 7,910	[6] 4,349	[6] 2,160	[1] 1,000
Germany [7]	3,444	7,000	3,000	3,000	4,000	5,000	4,000	(3)
Italy	-------	146	330	72	228	(3)	(3)	(3)
Japan	606	[1, 2] 2,000	[1] 2,500	(3)	[1] 4,000	(3)	[1] 2,000	[1] 1,000
Mexico	(3)	90	116	150	320	395	286	[1] 160
Netherlands	[8] 1,000	[1] 14,600	2,967	(3)	(3)	(3)	(3)	(3)
Netherlands Indies [5]	14,749	13,941	22,035	[1] 23,000	[1] 8,000	[1] 12,000	[1] 3,000	[1] 500
Norway	(3)	283	206	98	48	23	27	(3)
Portugal	[9] 2	30	781	1,481	2,381	3,058	373	182
Siam (Thailand)	[10] 113	(3)	(3)	(3)	(3)	(3)	(3)	[1] 7,000
Spain	-------	138	112	86	99	121	515	590
Union of South Africa	-------	-------	33	143	535	862	1,150	[1] 1,000
United Kingdom [1]	45,800	37,400	(3)	40,000	30,000	31,026	[1] 25,000	[1] 28,000
United States	-------	-------	[11] 1,391	[11] 1,839	[11] 16,168	[11] 21,489	[11] 30,884	[11] 40,475
Total (estimate)	165,000	177,600	227,000	225,000	109,000	118,000	105,000	[1] 98,000

1 Estimates by the authors.
2 Yearbook of American Bureau of Metal Statistics.
3 Data not available, estimate included in total.
4 Exports plus difference between carry-over at end and beginning of year.
5 Exports.
6 Unoccupied China.
7 Includes production of some secondary tin.
8 Estimated production in 1929.
9 Average for 1926–27.
10 Average for 1926–28.
11 Including tin content of ores used direct to make alloys.

REVIEW BY COUNTRIES

Australia.—Lack of manpower and drought continued to hamper tin mining in Australia in 1945. The output of Tableland Tin Dredging Co., in Queensland, was lower than normal owing to idleness of its dredge for extensive repairs in November and December. In New South Wales former important sources of tin were idle because of drafting or migration of miners. In Tasmania, Aberfoyle Tin, N. L., operated at a higher rate in 1945 than in 1944 but produced less tin, owing to a decline in grade of ore. A new crushing and screening plant was erected; and, with an improved labor supply since the termination of hostilities, delayed development has been undertaken. At Briseis Consolidated, N. L., the grade of ore continued to decrease; gravel washed in 1945 contained 0.65 pound of tin oxide per cubic yard compared with 2.5 pounds per cubic yard in 1943. Renison Associated Tin Mines, N. L., on the west coast of Tasmania, recovered a small tonnage of tin from a massive pyrrhotite and pyrite ore. After fine grinding, the classifier product is floated to remove the sulfide minerals and the cassiterite recovered by tabling. The cassiterite is fine, and the slime losses are high; average recovery was 61 percent. The Mount Bischoff properties are to be sold to the Commonwealth and State, and some exploratory work may be carried on. Working of lodes below the open-cut has not proved successful.

Belgian Congo.—It is unlikely that production of tin in the Belgian Congo in 1945 exceeded that in 1944. Exports, however, appear to have been larger in 1945, owing to shipment of carry-over from 1944. The African Metals Corp. contract for acquisition of tin from the Belgian Congo by the United States expires June 30, 1946. Under the terms of the contract, the United States paid 53 cents a pound for the tin, whether in the form of refined metal or concentrates (plus a 2-cent premium per pound if deliveries equaled or exceeded a specified tonnage) f. o. b. West African ports (Matadi). The Congo Tin Committee has been negotiating for a new contract on more favorable terms.

Total tin in metal and concentrates imported by the United States from the Belgian Congo declined 21 percent in 1945, largely owing to the resumption of shipments of metallic tin to Belgium. Metallic tin imported was 6,494 tons (10,000 in 1944) and tin in ore and concentrates 7,401 tons (7,549 in 1944).

Bolivia.—Exports of tin in concentrates and ore by Bolivia (42,465 tons) in 1945 were 10 percent more than in 1944 and were exceeded only by the 1929 peak of 46,343 tons. The United States was the destination of about 77 percent, and the remainder went to the United Kingdom. Owing to the large quantity in storage and en route at the close of the year, actual arrivals in the United States were only 25,984 tons from Bolivia. During 1945 exports of the Patiño group, amounting to 45 percent of the total, were about the same as in 1944, whereas those of the Hochschild group (28 percent) were 18 percent higher than in 1944. Those of Aramayo, with 7 percent, increased 15 percent; and the medium and small mines, with 20 percent, increased 21 percent. Exports were accelerated in the second calendar quarter because of an anticipated price reduction. A new purchase contract, important features of which are summarized in the section, Government Tin Operations, was not concluded until September and gave producers little opportunity to raise shipments to take advantage of the still unreduced price. In this, the third quarter of the year, a slight improvement in grade was noted, possibly as a result of the Banco Minero's discontinuance of purchase of concentrates carrying less than 20 percent tin. The downward trend in shipments continued into the fourth quarter.

It has been estimated that Bolivia will export the equivalent of 36,000 metric tons of fine tin in 1946; but even though this would be 17 percent below the 1945 figure producers are skeptical of its achievement, owing to higher production costs, the decline in prices, and other adverse factors. This was foreshadowed by the closing late in the year of the Huanuni mine of the Bolivian Tin & Tungsten Mines Corp. (Patiño group). This property had an output capacity of about 3,000 tons of fine tin yearly and employed about 2,000 miners. The reason assigned was the rise in costs from £334 a ton fine tin in 1944 to £402 (about 72 cents a pound) in August 1945. In the face of possible Government confiscation and operation authorized in a decree of March 29, 1945, an attempt may be made to reopen the mine. The Patiño Co. report for 1945 states that costs increased £38 14s. 1d. a long ton of tin over 1944. Apparently no new taxes were levied during the year, but use of foreign exchange proceeds from sales was limited further on a sliding-scale basis, with the greatest burden placed on exporters of the higher-grade materials. Strikes in the spring were followed by wage increases of about 15 percent, retroactive in the case of Patiño to January 1 and for Aramayo to April 1. President Villarroel warned Bolivia in November to prepare to face an acute economic crisis in 1946. Wages will not be increased, but additional taxes will be laid on industry profits. The export tax on tin already provides more than half the State's total revenue. The Banco Minero was given certain tax exemptions by the Government, which permitted purchasing the output of small mines at prices that would offset the greater penalties imposed for treatment of their low-grade output. To aid the small miners, whose tools and practices are primitive, an investment of $300,000 for a concentrating plant was planned by Banco Minero. Funds for the purpose were to be obtained through a loan from the Bolivian Development Corp. The abandoned tin-smelting venture at Oruro, which Mauricio Boni attempted in 1936, was revived. Banco Minero was empowered by a supreme resolution in April 1945 to loan B. 4,189,000 to complete the plant and bring it into operation within a year after the loan was granted. It was said that orders for some machinery had been placed in Argentina.

Production at Catavi was increased slightly by Patiño's new sink-float and Sullivan deck plants, but for a time mechanical difficulties affected performance of the sink-float plant. The Tainton volatilization plant at the Unificada mine of Hochschild has not yet proved commercially successful. Further changes in equipment were made in an effort to attain recoveries shown in laboratory tests. Anaconda round tables with concrete decks were installed at Potosi, Oploca, and Aramayo to replace buddles for the recovery of slimed tin. Additional flotation units were installed in the Colquiri mill of Cia. Minera de

Oruro. The Bolivian International Mining Corp. resumed operations in June 1945, with a new dredge replacing the one that had capsized in January 1944. The output was estimated at 30 tons of fine tin a month, but this seemingly has not been reached because of unfavorable operating conditions.

British Malaya.—After the fall of Manila to returning United States troops on February 4, 1945, Japan's already weakened lines of communication to southeast Asia virtually were cut off. Although the Japanese did not surrender Singapore and Malaya until September 14, it appears improbable that mining and smelting of tin could have been other than at a very low rate during 1945. Likewise, movement of stanniferous materials to Japan probably gave way to transport of more highly strategic goods. Up to the end of the year, according to the British Ministry of Supply, only 4,500 tons of tin had been found, whereas 17,000 tons had been reported erroneously in October. Up to the end of January 1946 only 2,300 tons of concentrates had been acquired by a tin-ore-buying agency.

In conjunction with the British Colonial Office, the Malayan Chamber of Mines appointed several committees to examine conditions in Malaya and assist in developing plans for rehabilitating the tin-mining industry and accelerating production. The Rehabilitation Committee that was to advise on the views of all sections of the industry included a representative each from Australia, China, France, and the United States. An Inspection Committee, which had an American representative,[9] arrived in Malaya in October 1945. Late in that month Arthur Notman and Charles Slaughter, American mining engineers, were selected to examine the state of mining facilities on behalf of the United States and in cooperation with the Inspection Committee. A. D. Storke, who had been appointed adviser to the Secretary of State for the Colonies on matters of rehabilitation, reached Malaya while that group was at work. At about the same time John J. Croston, assistant director of the Civilian Production Administration's Tin-Lead Division, also made an extensive survey of the far eastern tin situation as a special investigator for that agency. Summaries of their reports were published.[10]

Immediately before the war, there were 125 or 126 dredges in Malaya. In May 1941, the latest date for which information is available, 108 were in operation (about 104 in 1940), 15 idle, and the others under repair. These operations accounted for a little more than half the 1940 output of 80,651 tons tin content; about 35 percent came from gravel pumping; and most of the remainder was divided nearly evenly between hydraulicking, open-cut, and underground mines.

In general, upon reoccupation the dredges were found to be in better condition than had been anticipated. The Japanese had refloated and worked many of them while operable but apparently made no systematic effort to wreck them. Much electric and shop

[9] A. D. Hughes, resident manager of the Pacific Tin Consolidated Corp. This company, the sole American operator (Federated Malay States) had 5 dredges. At the time of evacuation in the winter of 1941–42 1 had been dismantled before moving, and 4 were sunk. These were refloated by the Japanese and were not seriously damaged. Two may be able to resume production by August 1946. The Japanese had worked 3 and some open-casts part of the time.

[10] The Storke reports appeared in American Metal Market, vol. 52, No. 235, Dec. 13, 1945, pp. 1, 5, and vol. 53, No. 24, Feb. 2, 1946, p. 1. The Notman-Slaughter statement was given in Iron Age, vol. 157, No. 1, Jan. 3, 1946, p. 202. A summary of Croston's findings appeared in American Metal Market, vol. 53, No. 145, July 30, 1946, pp. 1, 6.

equipment and many tools had been removed; repair parts and other stores had disappeared; but power plants were, for the most part, in fair shape. Official reports indicate that about one-third (41) of the dredges may begin operation by August 1946 and another third (46) by July 1947. Of the remainder, 22 are considered worthless. This group produced only about 10 percent of the dredge output, and several were obsolete before the war. The remaining 17 may come into production by 1948. This schedule assumes that repairs may be made without delay and that coal or other fuel will be available, the needed labor force recruited, and the currently highly inadequate basic food supply—rice—increased. Chinese mines that supplied about 30 percent of the prewar output, much of it by gravel pumping, suffered more severely than the dredging companies. A few were working at the time of the Japanese surrender, but out of 483 small Chinese mines only 71 are expected to resume by August 1946; output is not likely to be large until 1948. European-owned open-cast and hydraulic mines are expected to begin operation by August 1946. Hand (dulang) mining may yield 1,500 tons in 1946 and about 1,200 thereafter. Production from all categories of mining was estimated to be 12,300 tons of tin in 1946; 46,150 in 1947; 72,800 in 1948; and 73,500 in 1949. Thus, if hopes are realized, by the end of 1947, tin mining in Malaya will be restored to within 90 percent of the 53,500 tons annual average before the war broke out in Europe. Much of the recovery depends on the Government rehabilitation plan and war-damage allowances. Small companies may not be able to resume operations without Government aid. The Colonial Office has included approximately £8,000,000 for rehabilitation in Malaya in a proposal to the British Treasury. Compensation would be considered on the basis of losses due to command destruction before Japanese arrival or incident to Japanese occupation; and advances made would be paid back by the industry by 1950 at low interest rates. The Treasury, in turn, is considering whether full rehabilitation of the tin industry is necessary; how much of the total sum is to be expended on rehabilitation of tin mining against that for other commodities; and the effect of the program on general export policy. Apparently no war-damage settlement will be reached until full assessment of individual claims has been made, and it may be that amounts awarded for war damage would be credited against repayment of financial aid granted for rehabilitation.

Postwar costs are expected to exceed prewar costs substantially. The cost of new dredges has been estimated to be up at least 60 percent and smaller equipment about the same; wages are in doubt because they are related to the supply and the cost of food, much of which is now several times that of 1939. The cost of transportation has also increased more than 50 percent.

The tin smelters (formerly the largest in the world) were found to be in comparatively good condition. The Penang smelter of the Eastern Smelting Co., Ltd., had been used by the Japanese during their occupation and was ready to resume normal operation in December 1945. The prewar capacity of this smelter was 100,000 tons of tin concentrate a year. The Straits Trading Co., Ltd., smelters at Pulau Brani and Butterworth together had a little larger capacity. That at Pulau Brani, Singapore, which apparently was not used by

717372—47——48

the Japanese, was expected to begin operations on a small scale in May 1946. There has been no reference to conditions at the Butterworth and Selangor smelters. Singapore was virtually undamaged, its roads were in excellent repair, and its electric light plant was working, and shops opened within a few days of liberation. By the latter part of October 1945, American consular officers were on duty.

A tin-ore-buying agency was set up in Malaya by the British Ministry of Supply to acquire available existing supplies in all Malaya. The agency was to arrange for immediate shipment of any stocks found and will also cooperate with Chinese mine owners in solving their labor problems. The basic price to be paid for the tin was set up by the Ministry of Supply at £300 per ton Malayan port (53.87½ cents a pound or about 56 cents delivered United States). This price was in effect until February 16, 1946, when treatment charges (hitherto paid by agency) will be included among the deductions against the producer, but other charges were reported as having been substantially reduced. Concentrates purchased are expected to be smelted in Malaya. Buying seems to have been extended to include production of the smaller miners, who, however, do not seem to have responded very well to the price offered.

The British Government proposed to create a Malayan Union. It will consist of the four Federated and the four Unfederated States and of the British Settlements of Penang (Province Wellesley) and Malacca. Singapore will be constituted as a separate colony but may ultimately enter the new union.

Burma.—Preliminary observations indicate that the property of the Mawchi Mines, Ltd., was not damaged by military operations and enemy occupation as seriously as had been expected, but substantial deterioration did result from neglect. The plant for cleaning the concentrates has been entirely destroyed. Since the labor force was almost completely dispersed, the problem of recruiting another is the most urgent one facing the company. An inspection committee of the Lower Burma tin- and wolfram-mining industry is to prepare a report on conditions and requirements of the mining properties in that area. British Ministry of Supply agents on the committee will make ore and metal inventories and buy available stocks. The British Information Service has reported that the Japanese are believed to have left behind about 1,200 to 1,300 tons of tin concentrates in Lower Burma.

China.—Production of tin was probably much lower than in 1944, owing to an almost complete economic break-down, accompanied by continued civil unrest. Shortage of all goods and particularly foodstuffs is appalling, and reportedly conditions in the interior—the source of tin—are much worse than on or near the coast. The realization of postwar production plans therefore appears doubtful. The National Defense Council expected the first postwar year to show a 7,150-ton output, rising in 5 years to 14,000 tons. In an article on the Modernization of Chinese Mining,[11] T. Y. Chong said that official industrial plans called for an increase to 30,000 tons, or roughly three times the record output of prewar years. Mechanization of mining and milling would bring about the increase. The

[11] American Metal Market, vol. 53, No. 6, Jan. 9, 1946, p. 5.

Kochiu district in Yunnan Province is expected to provide about two-thirds the total and the Fuchuam, Hosien, and Chungsan districts in Kwangsi Province most of the remainder, with lesser quantities from Kiangsi and Kwantung Provinces. The National Resources Commission had already in operation a modernized smelter and mill in Yunnan and produced high-grade tin. A beginning on mine modernization had also been made, but Chong gave the impression that most of the mining, milling, and smelting was conducted as primitively as it had been several hundred years ago.

It has been reported that about 1,200 tons of tin were recovered in China from supplies taken by the Japanese.

Germany.—With the surrender of its armed forces in May 1945, Germany ceased to be a sovereign state. It had been the largest continental tin consumer for many years; except for the depression period, apparent consumption ranged from 9,000 to nearly 14,000 tons and for about 10 years was in the neighborhood of 12,000 tons, but in the period 1940–44 was reduced to about 7,125 tons. According to an announcement of the Allied Control Council from Berlin in March 1946, the permissible level of German industrial activity is set at one-half the 1938 rate. Specifically, 8,000 tons of tin may be used, but distribution in the several occupation zones was not given. Until the Arnhem smelter was constructed in the early 1930's, Germany had been the principal continental smelter and maintained several tin-processing plants through the war years. In the 1940–44 period, smelter output, including secondary tin and alloys, was reported to be 3,000 to 5,000 metric tons annually and averaged about 3,800 tons. Tin mining dates back to the Middle Ages but has been small, averaging about 150 tons a year from 1800 up to the beginning of rearmament for World War II. During 1940–44 tin-tungsten ores were mined principally in the Erzgebirge, and production was reported to have risen from 300 tons to 500 tons in 1942 and to 1,000 in each of the following 2 years. In 1945 output probably was negligible. The producing area is now in the Russian zone. During the war most of the ore supply came from Portugal and Spain, along with metal and tin-bearing materials seized in overrun countries. Germany's tin position was evidently becoming critical, for only about 3,000 tons of various brands were discovered after the surrender. In the American zone 841 tons were confiscated; but of this, 91 tons proved to be solder after arrival in the United States. Tin smelting and refining in northwestern Germany have been described.[12]

Indochina.—The tin mines of Indochina were seriously damaged during the war. Six months to a year will be required for making repairs before mining operations can be resumed. Internal political disturbances may, however, retard their rehabilitation. The tin smelter at Haiphong was reported as being intact, but reports on others are not available. A stock consisting of 560 tons of concentrates assaying 40 to 70 percent tin, and some 540 tons of metallic tin was discovered. Prewar production of tin in Indochina averaged around 1,500 tons of tin annually.

[12] Phillips, Albert J., Copper, Lead, Zinc, Tin and Antimony Smelting and Refining in Northwestern Germany: Office of Military Government for Germany (U. S.), Joint Intelligence Objectives Agency. FIAT Final Report 229, Oct. 2, 1945, 47 pp.

Japan.—Because of a large tin stock and the rapidly approaching Allied invasion it is doubtful whether tin mining and smelting were carried on to any extent in Japan in 1945. The industry was entirely disrupted by the time of the Japanese surrender on August 14. The Mitsubishi tin smelter in Osaka and the one of Toyo at Oita may have been damaged to some extent by bombing, but the tin mines in the interior probably were unharmed. Occupation authorities have directed that about 10,000 tons of the tin found in Japan are to be shipped to the United States for grading and analysis. Allocation will be determined by the Combined Tin Committee. It is believed that the Japanese may have obtained roughly 100,000 tons of tin from southeastern Asia after the fall of Singapore.

Netherlands.—The Arnhem tin smelter was being reconditioned in 1945, and production on a small scale may be resumed early in 1946. Before the war this plant was equipped to treat complex and refractory ores, as well as high-grade material. Ore supplies were usually obtained from the islands of Billiton and Singkep, Netherlands Indies; and Bolivia, Burma, and China. Only a small quantity of Banka ore was treated. The plant worked into 1943, and for a time the Germans provided Portuguese and Spanish material. In the latter part of 1944, when Arnhem was evacuated, the Germans removed virtually all the electrical equipment, ball mills, and mechanical separation and filtering plants and stripped the works' laboratory of apparatus and chemicals. However, the four blast furnaces were intact, apart from some minor damage, as were also the reverberatory and rotary furnaces, heavy machinery, and scrap-metal facilities. It has been reported that most of the equipment and many of the electric motors that the Germans removed have been located and that efforts were being made to obtain additional equipment from England.

Netherlands Indies.—The output of tin in the Netherlands Indies in 1945 was probably the smallest in almost a century. The Japanese mined and smelted tin during their occupation but on much less than the prewar scale. The sudden ending of the war in August 1945 prevented the Japanese from carrying out a scorched-earth policy. They were instrumental, however, in provoking a serious revolt among the natives against the Netherlands Government, which has had a delaying effect on restoration of tin mining. Owing to natural advantages and a higher degree of mechanization, tin production in Netherlands Indies should approach the prewar rate more rapidly than in Malaya. More than 6 of the 17 dredges on Billiton at the time of the Japanese occupation (February 1942) were found in repairable condition. Production was expected to be at the rate of not less than 10,000 tons of tin annually within 6 months. Half of the production is to go to the smelter at Texas City and the remainder to Arnhem for treatment. The Japanese are believed to have obtained about 3,800 tons of tin from Billiton in 4 years. Representatives of the Billiton Co. reached the island in October 1945 and have made some progress in restoring plant and equipment. Power plants were found to be in fair operating condition; but, as elsewhere, some of the electric apparatus, high-tension lines, and repair-shop equipment had been taken or destroyed. There had been little damage to dredges beyond removing parts, especially electric equipment, for use elsewhere. The Klappa Kampit lode mine on Billiton, which had a prewar annual output of 3,000 tons, had been thoroughly wrecked and cannot be worked for some time. A stock of 310 tons of tin was found in Billiton. Damage to mining installations on Singkep was serious, but tin production has been resumed on a small scale. Other than that tin production was progressing, there has not been much information concerning conditions on Banka, where the Indonesian rebels held control for some time. Two large dredges, which had been moved from Billiton to Banka in 1941, have been reported to be in good condition. Chinese coolies left on the island have returned to work, and by April 1946 all but 1 of the remaining 31 dredges were afloat and may be repaired. Two suction dredges had resumed operations, and 2 bucket dredges were to be in operation in May. It is understood that the smelters on Banka were in good condition and have resumed operations. Japanese on Banka reported there were almost 3,000 tons of Japanese-smelted metal and 3,500 of tin in concentrates on the island. Part of this was on its way to the United States by the end of 1945 and the first part of 1946. Progress on reconstruction work on Banka has not been as rapid as on Billiton. The Mining Equipment Corp., a Billiton Co. subsidiary in New York, has placed orders for 2 dredges and other equipment in the United States, and 6 are to be built in the Netherlands. Those from the United States are expected to be in operation early in 1947 and the others in 1947–48.

Nigeria.—Production of tin in Nigeria in 1945 about equalled that in 1944. Some of the mines were adversely affected by floods or other abnormal weather conditions, lowered ore grade, and shortage of native labor. In midsummer the movement of exports was affected by a labor strike of Government technical workers, which lasted over 6 weeks. After the fall of Malaya and the Netherlands East Indies, the British Ministry of Supply requested Nigerian producers to expand tin output to the limit. An agreement between the Ministry and the Nigerian Chamber of Mines fixed a price based on prewar costs and profits. Subsequently the producers received additional remuneration calculated on the average value of gravel worked each year compared with the average in the year before intensive operations were begun. The 100-percent excess profit tax rule was also modified. The mining companies have consistently complained that the price has been too low to compensate for the greatly increased cost of production, enforced contraction of development in favor of extraction, and the uneconomic practice of concentrating work on the higher-grade portion of the deposits.

The "cost plus" contract arrangement in force during the war expired December 31, 1945. The British Ministry of Supply has offered producers a new contract under which it would pay £300 per ton of metal f. a. s. port of shipment Nigeria, with a bonus of £25 per ton for any production exceeding the 1941 rate. The Nigerian Chamber of Mines refused to accept this price, as certain companies would operate at a loss under the terms, and presented their proposals, which the Ministry has not accepted. Under terms offered by the Ministry, the Amalgamated Tin Mines of Nigeria reports that its output would be reduced to 4,500 tons of concentrates annually, as compared to about 9,000, or half of the rate during the last 2 years.

The Geological Survey of Nigeria has been remapping the tin field on the Jos Plateau in a search for new deposits and has resurveyed a considerable area south of Bukuru.

Portugal.—Tin mining in Portugal continued to decline in 1945. Restrictions on tin sales and exports were removed, but the export of tin concentrates is not permitted. A decree of May 18, 1945, allowed tin to be sold freely in Portugal, and exports of metallic tin are allowed provided half the quantity shipped is purchased from the Government stock pile at Esc. 126 per kilo ($2.31 per pound). The only steady producer was the Gaia alluvial mine worked with a small dredge by the Portuguese American Tin Co.

Siam (Thailand).—The tin mines, including dredging equipment, in Siam fell reportedly undamaged into the Japanese hands in December 1941. The Japanese-controlled Government in December 1941 placed armed guards at the mines before the Japanese landed to prevent any destruction. Dredges taken over by the Japanese Army were later handed over to the Siamese Government, which operated them through a Government company for some time and presumably maintained others in stand-by condition. Some have been found to be in good order, while others were reported to require extensive overhauling. It is understood that numerous small smelters were set up and operated during the Japanese occupation. The British Ministry of Supply announced in London on November 3, 1945, that, according to a provisional report, 16,000 tons of tin concentrates and 4,000 of refined tin had been located in Siam. Disposition of the stocks has not been made public, but it is believed a substantial part will be made available to the United States. A British party left Singapore early in 1946 to inspect properties in Siam, and arrangements were being made to appoint a committee to inspect the Australian tin properties there.

Under terms of a peace treaty, Siam agrees to participate in any general international arrangement regarding tin which conforms with such principles regarding commodity arrangements as may be agreed to by the United Nations. Siam has also agreed to prohibit any exports of tin until September 1, 1947, except in accordance with recommendations of the Combined Boards in Washington or any successor body; to regulate trade in tin; and to stimulate production. The United States took an active part in the negotiations, although not formally a party thereto.

Spain.—The output of tin in Spain increased in 1945 following the fixing of the domestic price at 80 pesetas per kilo ($3.31 per pound). Production was mainly from small placers.

United Kingdom.—The United Kingdom ranks second both as a world smelter of tin ore and as a consumer of pig tin. It is also second among the world producers of tin plate, which usually accounts for 40 percent of its pig-tin consumption. Foreign trade in tin was greatly changed by the course of the war. From the time of the Munich agreement to the fall of Singapore imports of tin ore increased materially above the prewar level and reached 83,902 long tons (gross weight) in 1940, dropped to little more than half that in 1942, and reached a low point of 32,948 tons in 1944. Pig-tin imports fell from nearly 12,000 tons in 1938 to zero in 1941 and remained entirely negligible through 1945. Tin exports (including reexports) averaged about 18,500 tons in 1938–39, dropped sharply to 6,500 tons in 1941, and for the next 4 years averaged about 8,500. Of the 6-year (1940–45) total of 56,000 tons, a large part was sent to Russia. Stocks (tin content) gained about 20,000 tons from 1939 to 1945. In the period 1935–38 consumption of virgin tin averaged about 22,000 tons. In the following 3 years the average was roughly 30,000 tons, with an apparent peak near the 34,000 ton mark. After the loss of Malaya, consumption was cut drastically and averaged about 19,000 tons for the 1942–45 period, with the lowest point at 16,400 tons in 1945. The use pattern in this period differed from that in the United States but cannot be expressed with certainty, as the distribution between primary and secondary tin for the various product classes was not given. However, it seems to have been about as follows for primary tin: Tin plate, about 4,300 tons a year; for solder probably somewhat more; and for bearing metals—principally babbitt and bronze—possibly 60 to 80 more than for tin plate. The contrast is more striking in terms of total tin. In the United Kingdom the relative totals, in the order given, were about 1, 1.7, and 3.2, whereas in the United States they were about 1, 0.5, and 1.5. The extraordinarily subordinate position of tin plate was due largely to the transfer of export markets to the United States, already noticeable in 1940 when American exports exceeded the British.

Cornish tin mining, which began before the Christian era, is rapidly becoming extinct. Available records show that its heyday was from the middle of the Civil War to the depression of 1893 and averaged something over 9,000 tons, with a peak of closely 11,000 in 1871. In the first 2 decades of the current century, production was about half that of the 30-year period mentioned; was more than halved again (about 1,930 tons) in the succeeding 2 decades; and in 1945 was 993 tons. South Crofty, now the only property working in the Camborne-Redruth area, has encountered a new complex lode containing both coarse tin and wolfram, which may add considerably to its ore reserves. Geevor received notice of termination of its agreement with the Ministry of Supply as of June 30, 1945. It had carried out some development work but was hampered owing to labor shortage. The Ministry of Fuel and Power withdrew its support from East Pool and Agar, as the scheme for a development and diamond-drilling program was not accepted, and mining and milling operations were stopped June 2, 1945.

The output of tin plate increased to 278,700 tons in 1945 from 249,400 in 1944, and there was good demand in evidence from home consumers as the year closed. Although control remained in force throughout the year, restrictions on the use of tin plate were eased during the latter part of 1945. Export orders greatly exceeded the tonnage that South Wales could supply, and it was necessary to withhold commitment on all export inquiries for deliveries in first half of 1946. Permits for export were issued against special priorities only. Shortage of labor has made it impossible to expand export business by reopening more mills. In July 1945 less than 10,000 were employed compared with nearly 25,000 in 1939. Demobilized workers have been reluctant to return to the industry. About 200 mills could reopen within a reasonable time if labor were available and would almost double the present output in Wales. Controlled selling prices for tin plate remained in force during 1945, but under an upward revision of steel prices authorized by the British Ministry of Supply December 31, 1945, the official maximum price for the home trade has been raised from 29s. 9d. to 32s. 6d. per box, f. o. b. makers' works; and from 30s. 9d. to 35s. to 37s. f. o. b. works' port for export, varying considerably according to the country of destination.

Acceptance of the redundancy scheme by the Board of Trade was an important feature of the tin-plate industry of Wales in 1945. Tinplate Scheme, Ltd., has been formed to carry out the scheme. It will handle all financial matters involved; receive and hold the contracts from the makers whose plants are sterilized; and see that they are enforced. The cost of the plan, £420,000, is to be borne by a levy of 6d. per base box on tin-plate production since April 1, 1943.

ARSENIC

By Allan F. Matthews and R. Louise Bryson

SUMMARY OUTLINE

GENERAL STATEMENT

Domestic production of white arsenic decreased a third in 1945 compared with 1944, but a gain in imports cushioned the decline in new supply to 19 percent. Consumption receded about 12 percent; the greater decline in new supply created a deficit bridged by reductions in exports and drafts on stocks.

Arsenic was under allocation control by the War Production Board from May 22, 1942 (Order M–152 and later M–300, Schedule 46) to August 11, 1945, when control was terminated. The lead shortage during 1945 induced the WPB March 27 (Order M–384 amended) to restrict the quantity of lead available to insecticides manufacturers to 45 percent per quarter of that used in the first half of 1944 or to 1,000 pounds of lead, whichever was greater; this 10-percent cut was less than the reduction in demand for lead arsenate and thus did not hamper its manufacture. White arsenic continued to be quoted at 4 cents a pound throughout 1945, and prices of arsenical insecticides were maintained at levels fixed by the Office of Price Administration in 1943 (Maximum Price Regulation 315 as amended April 6, 1943).

Salient statistics for white arsenic in the United States, 1941–45

	1941	1942	1943	1944	1945
Production short tons	32,481	28,681	31,202	36,094	24,349
Imports for consumption do	10,292	16,350	16,112	9,965	13,149
Exports do	[1] 1,616	[1] 305	1,975	2,401	858
Consumption do	40,442	41,520	51,083	43,500	[2] 38,100
Price per pound, end of year	$0.04	$0.04	$0.04	$0.04	$0.04

[1] Exports by producers only. [2] Apparent consumption.

DOMESTIC PRODUCTION

White arsenic production in the United States was 33 percent less in 1945 than in the peak year 1944 but was greater than in any year before the 1940's. The bulk of the output was a byproduct of copper and lead smelting by the American Smelting & Refining Co. at Tacoma, Wash., El Paso, Tex., and Murray, Utah; by the Anaconda Copper Mining Co. at Anaconda, Mont.; and by the United States Smelting, Refining & Mining Co. at Midvale, Utah.

Wartime demand for arsenic induced Government-owned Metals Reserve Company in 1943 to make five contracts for production of white arsenic from materials other than those ordinarily treated. The original objective was 65,337 short tons by 1948, but a drastic cut-back in military requirements in early 1944 resulted in subsequent cancellation of contracts, and only 42 percent of the stipulated quantity was delivered.

Production of high-arsenic ore by the United States Smelting Co. at Gold Hill, Utah, ceased January 15, 1945, but stocks continued to be treated at Midvale until later in the year. During the 16 months' operation from its reopening in September 1943, 98,784 short tons of ore were mined; treatment was principally at Midvale, but the overflow went to the smelter at Murray, Utah, which also handles flue dust from the roasting of arsenical gold ore at the property of Getchell Mine, Inc., Potosi district, Red House, Nev. No white arsenic was produced by Jardine Mining Co., Jardine, Mont., from its arsenic-gold-tungsten ores in 1945, but a stock pile of several hundred tons of material averaging about 75 percent As_2O_3 remained on hand during the year.

The Anaconda Copper Mining Co. makes metallic arsenic from a portion of its refined white arsenic output. Shepherd Chemical Co., Cincinnati, Ohio, produces sodium arsenite solution for weed killer directly from Canadian cobalt-nickel concentrates. From such concentrates the Ferro Enamel Corp., Cleveland, Ohio, formerly manufactured calcium arsenate and from Burma speiss its subsidiary, the Ferro Enamel Supply Co., from November 1943 to September 1944 likewise produced calcium arsenate, but neither company manufactured the compound in 1945.

White arsenic produced and sold by producers in the United States, 1941–45

Year	Crude			Refined			Total		
	Production (short tons) [1] [2]	Sales		Production (short tons)	Sales		Production (short tons)	Sales	
		Short tons	Value [3]		Short tons	Value [3]		Short tons	Value [3]
1941	26,843	28,661	$844,793	5,638	6,123	$274,527	32,481	34,784	$1,119,320
1942	25,658	27,981	1,198,424	3,023	3,057	161,942	28,681	31,038	1,360,366
1943	26,269	27,588	1,251,790	4,933	4,835	267,916	31,202	32,423	1,519,706
1944	31,182	29,159	1,370,602	4,912	5,313	326,217	36,094	34,472	1,696,819
1945	21,358	22,180	1,041,614	2,991	2,630	155,447	24,349	24,810	1,197,061

[1] Excludes crude consumed in making refined.
[2] Compounds made directly from ores, flue dust, and speiss contained white arsenic as follows: 1942, 290 tons; 1943, 172 tons.
[3] Partly estimated.

Deliveries of domestic white arsenic to Metals Reserve Company under Government contracts, 1943–45, in short tons [1]

Producer and source material	Deliveries				Initial objective	Date of contract, 1943
	1943	1944	1945	Total		
American Smelting & Refining Co. from—						
Getchell flue dust	432	1,974	--------	2,406	10,000	June 14
Gold Hill ore	--------	2,559	--------	2,559	1,267	Sept. 18
Richmond Eureka speiss [2]	136	1,094	--------	1,230	2,070	June 26
Jardine Mining Co. from—Jardine ore	--------	127	1,000	1,127	5,000	June 17
U. S. Smelting, Refining & Mining Co. from—						
Gold Hill ore	2,746	12,419	4,682	19,847	47,000	Mar. 10
	3,314	18,173	5,682	27,169	65,337	--------

[1] Data from Metals Reserve Company, subsidiary of Reconstruction Finance Corporation. Dates of delivery conform to bookkeeping entries rather than physical shipments.
[2] From Richmond Eureka Mining Co., Eureka, Nev. Figure for objective is revised.

FOREIGN TRADE [1]

Imports of white arsenic in 1945 conformed to the 1941–44 average but equaled only two-thirds of the peak 1937 entries. Mexico and Peru are the principal sources. All the metallic arsenic was from United Kingdom. The sulfide reported by the United States Department of Commerce from Peru in 1945 is probably not pure material and may consist of concentrates or impure white arsenic.

Exports of white arsenic in 1945 were less than half of the preceding decade's average; about four-fifths went to the British Commonwealth. Calcium arsenate was exported principally to Peru (42 percent) and Colombia (29 percent), lead arsenate to Brazil (63 percent) and Argentina (13 percent); and paris green—largely for malaria control—to Colombia (36 percent), Cuba (18 percent), and Egypt (16 percent).

White arsenic [1] imported for consumption in the United States, 1941–45, by countries

Country	1941		1942		1943 [1]		1944 [1]		1945 [1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Canada	862	$58,850	1,449	$32,977	35	$2,349	5	$100	1	$73
Japan	193	10,668								
Mexico	9,237	528,488	14,901	859,836	15,974	870,380	7,654	424,911	9,665	533,305
Peru					103	3,945	2,306	120,344	3,483	154,595
	10,292	598,006	16,350	892,813	16,112	876,674	9,965	545,355	13,149	687,973

[1] Figures for 1943–45 represent arsenic trioxide (As_2O_3) content; not strictly comparable with earlier years.

Arsenicals imported into and exported from the United States, 1941–45, by classes, in pounds

Class	1941	1942	1943	1944	1945
Imports for consumption:					
White arsenic	20,583,253	32,700,351	[1] 32,224,879	[1] 19,929,608	[1] 26,297,962
Metallic arsenic	2,240	6,854	6,840	21,395	51,501
Sulfide	11,025				2,226,560
Calcium arsenate	1,230,960	215	514		
Sheep dip	264,350	272,540	545	159,867	197,000
Paris green and london purple [2]	12,000				
Sodium arsenate			133,247		
Exports:					
White arsenic [3]	[4] 3,231,536	610,206	3,950,657	4,802,932	1,715,855
Calcium arsenate	5,897,598	3,941,722	6,384,559	2,411,095	3,499,625
Lead arsenate	9,594,483	592,029	3,054,326	4,265,513	6,339,103
Paris green (cupric acetoarsenite)	[5] 224,976	171,644	1,062,640	1,138,435	456,811

[1] Arsenic trioxide (As_2O_3) content; not strictly comparable with earlier years.
[2] According to U. S. Department of Agriculture, there have been no imports of london purple since 1936.
[3] 1941-42: As reported to Bureau of Mines by the producers; 1943–45: As reported by U. S. Department of Commerce.
[4] Dealers exported an additional 1,077,244 pounds.
[5] Figures cover July to December; not separately classified before July 1.

CONSUMPTION AND USES

Apparent consumption of white arsenic in the United States in 1945 (taking into account changes in Government-owned Office of Metals Reserve stocks) was 38,100 short tons, 14 percent less than the 1941–44 average but higher than any other prior year. Cessation of

[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

military demand and a less extensive boll-weevil infestation than usual were the most influential factors. Due partly to the latter factor and to the seasonal low demand for insecticides, arsenic consumption in the final 3 months of 1945 was less than half that of any of the three preceding quarters.

More than half of the arsenic supply is enlisted in the fight against insects, which destroy about 10 percent of all food and fiber crops. Lead arsenate is used primarily to protect apple trees against the codling moth and other fruit orchards, home gardens, and ornamental trees against various chewing insects. Calcium arsenate is utilized principally to combat the boll weevil in cotton fields, but a little is used with paris green in controlling potato bugs and cabbage "worms." According to one investigation,[2] the organic preparation DDT (dichloro-diphenyl-trichloroethane) is more effective than lead arsenate as a general insecticide but not so satisfactory as calcium arsenate against the boll weevil. The insecticide situation is currently described in Industry Report—Chemicals and Allied Products, issued monthly by the United States Department of Commerce.

The second-largest use of arsenic is as a weed killer, particularly on railroad rights-of-way and Hawaiian sugar plantations. Organic compounds, such as Polon (modification of 2,4-dichloro-phenoxyacetic acid),[3] are competitive where selective weed killing is required.

Production of arsenical insecticides, consumption of arsenical wood preservatives, and production of arsenical drugs in the United States, 1941–45

Year	Production of insecticides (short tons)[1]			Consumption of wood preservatives (pounds)[2]		Production of drugs (pounds)[3]
	Lead arsenate (acid and basic)	Calcium arsenate (100 percent $Ca_3(AsO_4)_2$)	Paris green (cupric aceto-arsenite)	Wolman salts (25 percent sodium arsenate)	Zinc meta-arsenite	
1941	[4] 36,656	29,684	2,073	1,656,014	268,795	(5)
1942	31,789	38,898	[6] 2,000	1,307,830	239,786	66,753
1943	40,478	34,932	1,944	769,316	53,516	83,026
1944	45,352	22,154	2,265	782,256	11,503	100,190
1945	35,596	13,920	1,950	(5)	(5)	[7] 36,759

[1] 1941, Bureau of Mines; 1942–45, U. S. Bureau of the Census. Figures for 1945 comprise 11 months actual and December estimated.
[2] U. S. Forest Service.
[3] War Production Board.
[4] Excludes basic lead arsenate.
[5] Data not available.
[6] Estimated.
[7] January to June, inclusive.

Arsenic is also used in the manufacture of glass, lead-base alloys, dyestuffs, cattle dip, wood preservatives, poison bait, and chemical warfare gases and in the Thylox purification of industrial gases. Demand for arsenical pharmaceuticals is declining rapidly with the advent of the penicillin treatment for venereal diseases. A fluorescent lamp shaped like an ordinary incandescent bulb and utilizing arsenic instead of mercury to produce the ultraviolet radiations[4] has been developed by Westinghouse Electric Corp.

[2] Chemical and Engineering News, Patent Status of DDT Explained by Swiss Geigy Company Officials: Vol. 23, No. 17, Sept. 10, 1945, p. 1538.
[3] Chemical Industries, vol. 57, No. 5, November 1945, p. 877.
[4] Science News Letter, New High-Efficiency Fluorescent Lamp: Vol. 49, No. 4, Jan. 26, 1946, p. 56.

An effective antidote for arsenic poisoning, known as BAL (British anti-lewisite, 2, 3 dithiopropanol), was discovered by Prof. R. A. Peters, Oxford University, as a result of 20 years of research. [5]

White arsenic consumed in the United States, 1943–45 by uses [1]

Use	1943		1944		1945 (Jan.—Sept.)	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Insecticides	29, 195	57	27, 050	62	17, 846	53
Weed killer	3, 243	6	7, 700	18	9, 827	29
Glass	200	1	3, 000	7	2, 184	6
Wood preservative [2]	524	1	300	1	234	1
Dyestuffs	1, 004	2	570	1	420	1
Metal and alloys	609	1	700	2	874	3
Other [3]	16, 308	32	4, 180	9	2, 473	
Total consumption	51, 083	100	43, 500	100	33, 858	100

[1] Data from War Production Board; based on allocations.
[2] Includes wallboard.
[3] Gas purification, pharmaceuticals, cattle dip, paint, poison bait, military, and other uses.

PRICES

The quoted price for white arsenic remained at 4 cents a pound for the fifth consecutive year, according to Oil, Paint and Drug Reporter. The base price of lead arsenate in carlots was set at 11–11½ cents a pound by the Office of Price Administration February 8, 1943 (Maximum Price Regulation 315). An amendment effective April 6, 1943, fixed the base ceiling price of other insecticides as follows (cents per pound in carlots): Calcium arsenate, 7–7½ cents; paris green, 20–25 cents; and london purple, 7–8 cents.

The London price of white arsenic, 95–100 percent, 2-ton lots, was held by the British Ministry of Supply at £50–£60 per long ton from October 1943 to March 1945, according to Metal Bulletin. It was lowered to £40–£50 during April to September and £20¼–£31 for the remainder of 1945. The quotation for arsenic metal, 99-percent, was £375 per long ton in 1944 and three quarters of 1945 and reduced to £325 for the final quarter.

STOCKS

Stocks of white arsenic held by producers and Government-owned Office of Metals Reserve decreased 26 percent during 1945, largely as a result of disposal of a third of the Metals Reserve stock pile. Chemical Warfare Service of the War Department, whose need for arsenic was drastically curtailed in 1944, returned to the market enough white arsenic to reduce its stocks from 3,191 short tons on April 1, 1944, to 1,142 tons on January 1, 1945, and 732 tons on July 1, 1945. Producers' stocks of calcium and lead arsenates are believed to have remained at nearly the same high level at the end of 1945 as at the end of 1944.

[5] Science News Letter, Arsenic Poison Remedy: Vol. 48, No. 22, Dec. 1, 1945, p. 338.

Year-end stocks of arsenic compounds in the United States, 1941–45 in short tons

Year	White arsenic			Calcium arsenate [1] (producers)	Lead arsenate [2] (producers)
	Producers	Govern-ment	Total		
1941	4, 518	------	4, 518	1, 786	5, 108
1942	2, 187	2, 693	4, 880	2, 584	2, 223
1943	1, 138	1, 018	2, 156	4, 757	4, 020
1944	2, 760	3, 029	5, 789	7, 648	7, 404
1945	2, 299	1, 987	4, 286	[3] 6, 389	[3] 6, 869

[1] Basis, 100 percent $Ca_3(AsO_4)_2$. From U. S. Department of Commerce.
[2] Acid and basic. From U. S. Department of Commerce.
As of September 30; year-end data not available.

WORLD PRODUCTION

World production of white arsenic in recent years, insofar as data are available, is shown in the accompanying table.

World production of white arsenic, 1936–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

County [1]	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
Australia:										
New South Wales	124	------	------	------	------	------	------	------	(2)	(2)
Western Australia	3, 526	2, 087	4, 063	1, 439	3, 385	3, 432	2, 771	2, 320	2, 341	(2)
Belgium-Luxembourg (exports)	2, 731	3, 039	2, 706	3, 332	(2)	(2)	(2)	(2)	(2)	(2)
Brazil	732	717	519	713	1, 088	1, 172	900	970	840	(2)
Canada	619	630	987	790	950	1, 605	3, 562	1, 430	1, 192	921
China	(2)	(2)	(2)	(2)	800	(2)	(2)	(2)	(2)	(2)
France	9, 750	6, 501	(2)	(2)	9, 220	6, 143	2, 255	3, 735	1, 943	(2)
Germany (exports)	2, 739	2, 852	2, 845	1, 782	(2)	(2)	3, 580	5, 604	(2)	(2)
Greece	85	234	77	113	117	(2)	(2)	(2)	(2)	(2)
Hungary	------	100	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Italy	------	------	810	1, 151	1, 283	1, 200	(2)	(2)	(2)	(2)
Japan	2, 629	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Korea (Chosen)	230	341	132	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Mexico	8, 527	10, 762	8, 894	7, 063	9, 268	12, 844	18, 520	20, 301	15, 306	15, 013
Peru	------	------	------	------	------	------	7	1, 195	6, 900	2, 717
Portugal	150	112	1	426	410	535	(2)	(2)	(2)	(2)
Rumania	------	6	3	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Southern Rhodesia	------	------	19	------	(2)	(2)	[3] 17	(2)	(2)	(2)
Spain	------	------	11	(2)	14	94	222	239	337	(2)
Sweden (sales) [4]	8, 647	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	155	97	66	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United States	13, 952	15, 253	15, 136	20, 267	22, 664	29, 466	26, 019	28, 306	32, 744	22, 089
	55, 700	56, 000	59, 000	63, 000	71, 000	(2)	(2)	(2)	(2)	(2)

[1] Arsenic is also believed to be produced in Czechoslovakia, Iran, New Zealand, Spanish Morocco, Turkey, and U. S. S. R. Production figures are not available for these countries.
[2] Data not available; in 1936 to 1940, inclusive, estimate included in total.
[3] August to December, inclusive.
[4] Arsenic content of ores mined was as follows—1936: 23,312 tons; 1937: 20,954 tons; 1938: 21,480 tons. Data not available for later years.

Argentina.—Two chemical factories in Argentina undertook the manufacture of lead arsenate in 1944. An output of 300 metric tons was anticipated for the 1944–45 spraying season.[6]

Australia.—Annual requirements of white arsenic, amounting to about 2,000 metric tons, are being met by domestic production.[7]

[6] Foreign Commerce Weekly, Lead Arsenate Production in Argentina: Vol. 20, No. 3, July 14, 1945, p. 33.
[7] Chemical and Engineering News, Australian Arsenic: Vol. 23, No. 22, Nov. 25, 1945, p. 2145.

Over 90 percent of the arsenic produced in Australia is obtained from the Wiluna district, East Murchison gold field, Western Australia. The principal sources are Wiluna Gold Mines, Ltd., and Moonlight Wiluna Mines, Ltd.[8]

Brazil.—About half the total arsenic requirements of some 1,600 metric tons have been produced domestically.[9] The largest producer is St. John del Rey Mining Co. at Morro Velho, followed by Companhia Minas de Passage, Mariana, and Companhia Brasileira de Mineracao, Caete—all gold operators in central Minas Gerais. A new Cottrell precipitator at Morro Velho and other developments underway are expected to increase white arsenic capacity to 2,000 tons annually.[10]

Canada.—Newcor Mining & Refining, Ltd., subsidiary of Wampum Gold Mines, Ltd., expects by June 1946 to begin production of gold and arsenic at Douglas Lake, Saskatchewan, 3 miles southwest of Flin Flon. The property is equipped with a 100-ton mill and a 50-ton arsenic recovery unit.[11]

France.—Production of calcium arsenate increased from less than 1,000 metric tons annually in prewar years to 15,000 tons in 1943; as a result of war damage to two factories, output dropped to 12,000 tons in 1944. Manufacture of aluminum arsenate has also expanded. Both compounds, derived from local arsenical gold ores, are used principally in the potato fields.[12]

Germany.—Arsenic produced in Germany during World War II was obtained from the arsenopyrite deposits at Reichenstein, Altenburg, and Rothenburg in Silesia, and from the Mansfeld copper mines.[13]

Iran.—Orpiment and realgar are mined at Zarah Shah at a rate of 500 to 600 metric tons of selected ore annually. The ore is transported 120 miles by camel to Zaryan station and thence by rail to the Keredj insecticide factory.[14]

Mexico.—Arsenical flue dust is recovered in Cottrell units of lead smelters of the American Smelting & Refining Co. at San Luis Potosi and the American Metal Co., Ltd., at Torreón and Monterrey. The flue dust from both smelters is sent to the lead refinery of the former company at Monterrey for extraction of white arsenic. A new chemical plant in Juarez has a scheduled daily output of 1 metric ton of calcium arsenate and about 100 kilograms of white arsenic.[15]

Peru.—The process for recovering white arsenic at the Oroya smelter of Cerro de Pasco Copper Corp. was described.[16] The corporation has begun construction of a calcium arsenate plant.[17]

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[8] Bureau of Mines, Foreign Minerals Survey: Vol. 2, No. 3, March 1945, pp. 100–101.
[9] Chemical and Engineering News, vol. 23, No. 11, June 10, 1945, p. 1020.
[10] Engineering and Mining Journal, vol. 146, No. 1, January 1945, p. 126.
[11] Swain, E., A Review of the Mineral Industries in Saskatchewan: Western Miner, vol. 19, No. 4, April 1946, p. 64.
[12] U. S. Department of Commerce, Industry Report—Chemicals and Allied Products: April 1946, p. 27.
[13] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 2, Aug. 20, 1945, p. 5.
[14] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 4, Oct. 20, 1945, p. 3.
[15] Chemical and Metallurgical Engineering, Calcium Arsenate Plant Built in Mexico: Vol. 52, No. 5, May 1945, p. 166.
[16] Fowler, W. W., Hanley, J. W., and Barker, I. L., Ore Reduction—Copper and Lead Smelting and Lead Refining: Min. and Met., vol. 26, No. 467, November 1945, pp. 545–555.
[17] Skillings' Mining Review, Cerro de Pasco Looks to World Markets: Vol. 35, No. 3, May 4, 1946, p. 11.

Sweden.—No arsenic was refined during World War II, but appreciable quantities were sold from stock for wood preservation.[18] About 5 million cubic feet of wood are impregnated annually by the Boliden method,[19] an open-tank process utilizing arsenic acid, sodium arsenate, sodium bichromate, and zinc sulfate dissolved in water.[20] The bulk of the enormous quantity of white arsenic, reportedly exceeding 300,000 tons, stored by the Boliden Mining Co. is believed to be too low-grade in its present state for the insecticide and glass trade. Most of the several thousand tons of high-grade refined white arsenic on hand at the end of the war was exported to United Kingdom, Australia, Union of South Africa, and South America.[21]

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[18] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 3, Sept. 20, 1945, p. 4.
[19] Metal Bulletin (London), No. 2922, Aug. 29, 1944, p. 14.
[20] Hager, Bror, Preservation of Wood: Chem. Age (London), Vol. 54, No. 1397, Apr. 6, 1946, pp. 365-367
[21] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 4, Apr. 20, 1946, p. 5.

BISMUTH

By Allan F. Matthews

SUMMARY OUTLINE

GENERAL STATEMENT

United States production and imports of refined bismuth were at the same level in 1945 as in 1944. A 12-percent increase in consumption and a rise in exports were met by withdrawals from stocks. The War Production Board relinquished allocation control of bismuth August 21, 1945, by revoking Order M-276 (effective February 1, 1943) on metallic bismuth and Schedule 88 of Order M-300 (successor to Order M-295, effective April 1, 1943) on bismuth chemicals. The prices of bismuth metal and salts remained fixed during 1945 at levels of March 1942, in accordance with the Office of Price Administration General Maximum Price Regulation, effective May 11, 1942.

DOMESTIC PRODUCTION

The quantity of refined bismuth produced in the United States in 1945 was approximately the same as in 1944 and as the average for 1935-41. Peak output was in 1942. The Bureau of Mines is not at liberty to publish data showing the domestic production of bismuth.

Three primary producers recover byproduct bismuth principally from domestic and imported lead and copper ores and from Mexican bismuth-lead bullion bars. The American Smelting & Refining Co. produces bismuth-lead alloys at its Selby, Calif., Perth Amboy, N. J., and Monterrey, Mexico, plants for refinement at Omaha, Nebr. From Montana copper and Utah lead ores the Anaconda Copper Mining Co., through its subsidiary International Smelting & Refining Co., produces bismuth-lead bullion at Tooele, Utah, and refines it at East Chicago, Ind. The United States Smelting, Refining & Mining Co. ships bismuth-lead bullion from Midvale, Utah, for refinement at East Chicago, Ind., by its subsidiary, U. S. S. Lead Refinery, Inc. The principal importer and consumer is the Cerro de Pasco Copper Corp., New York, which refines large quantities of bismuth in Peru.

Deliveries of refined bismuth by domestic producers to Government-owned Metals Reserve Company to the beginning of 1945 comprised 391,968 pounds from domestic and foreign ores and 568,020 pounds from Mexican bismuth-lead bullion. Additional deliveries during 1945 were 12,347 and 2,000 pounds, respectively. The former quantity includes 3,494 pounds from the ores of Alta United Mines Co., Little Cottonwood district, Alta, Utah. That was the total Alta bismuth delivered to Metals Reserve Company under a contract drawn up April 6, 1944, for prompt delivery of ore containing 100,000 pounds of bismuth, later modified to cover production through December 31, 1944, and then canceled August 1945.

FOREIGN TRADE[1]

Imports.—All entries of refined metallic bismuth in 1941–45 were from Peru. There were no imports of bismuth ore or concentrates in 1945. Preliminary figures for bismuth-ore imports from Bolivia, reported in Minerals Yearbook, 1944, may be assumed to be final. Almost the entire Mexican bismuth output (see world production table) is imported in the form of bismuth-lead bars for refining in the United States.

Bismuth imported for consumption in the United States, 1941–45

Year	Bismuth ore[1]			Refined metallic bismuth		Bismuth compounds and mixtures	
	Pounds		Value	Pounds	Value	Pounds	Value
	Gross weight	Bi content					
1941	(1)	(1)	(1)	223,477	$223,463	41	$744
1942	(1)	(1)	(1)	(2)	(2)	7	22
1943	138,600	48,800	$52,400	[3] 430,874	[3] 397,676	13	53
1944	118,739	51,349	60,878	363,980	345,796	40	352
1945				333,231	316,135		

[1] Figures from Foreign Economic Administration. Those for 1941–42 are not available but are believed to be negligible.
[2] No "imports for consumption"; general imports of 222,684 pounds were reexported.
[3] An additional 71,236 pounds (valued at $43,498) reported by the U. S. Department of Commerce as "bismuth" is ore and is covered by that category in this table.

Exports.—Exports of bismuth metal and alloys were 10 times greater in 1945 than in 1944 but still considerably less than in 1941. Destinations were France (96 percent), Chile (2 percent), and 12 other countries (2 percent).

Bismuth exported from the United States, 1943–45, by classes

Class	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Matte	10	$20	46	$74		
Metal and alloys	16,209	10,745	10,161	8,557	115,543	$149,031
Compounds and mixtures:						
Carbonate	25,795	42,055	46,761	67,725	22,197	35,178
Chloride	2,438	6,967	501	1,473	(1)	(1)
Gallate	7,278	11,515	8,429	13,302	(2)	(2)
Iodide	551	1,484	2,884	1,432	(2)	(2)
Nitrate	33,259	45,279	42,845	56,319	78,895	105,061
Oxide	345	1,226	355	1,154	(1)	(1)
Sulfate			2	20	(1)	(1)
Other	6,412	13,609	11,299	26,482	[1] 22,331	[1] 50,902

[1] Beginning January 1, 1945, included with "Other."
[2] Beginning January 1, 1945, data not available; included with "Medicinal chemicals for prescription use, n. e. s."

[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

CONSUMPTION AND USES

Domestic bismuth consumption increased 12 percent in 1945 over 1944 and was greater than in any years except 1942 and 1943. Apparent consumption was 2,500,000 pounds in the peak year 1942.

Of the bismuth consumed in the United States in 1945, pharmaceuticals manufacturers utilized half, that is, some 840,000 pounds, a quantity approximating the average consumed for that purpose during the past decade. Bismuth pharmaceuticals comprise principally antisyphilitic drugs, indigestion remedies, and cosmetic powders. The demand for bismuth drugs is expected to decline as the penicillin method for treating venereal disease becomes more prevalent.

Metallurgical uses represented 49 percent of the bismuth consumption in 1945 compared with 55 percent in 1942–44 and about 25 percent in the middle 1930's. Alloys of bismuth (35–60 percent) with lead, tin, and cadmium melt at low temperatures and either expand or exhibit no appreciable volume change on solidification, promoting sharp reproduction of surfaces against which they are cast. One of these alloys, "Cerrolow 105," contains indium and has a melting point of 105° F. The group of alloys is used by the aircraft and automotive industries to prepare spotting fixtures, to make molds for electroforming, to fill thin-walled tubing during bending, to anchor fragile parts in machining or testing, to proof-cast forging dies and molds, to spray-coat wooden patterns and core boxes in foundries, and to liquid-seal bright-annealing and nitriding furnaces.[2]

Other bismuth alloys are used as solders, coatings for selenium rectifiers, and safety fuses in electrical circuits, compressed-gas cylinders, fire sprinklers, and fire-door releases. Small additions of bismuth to aluminum alloys, malleable irons, and certain steels increase machinability. The principal aluminum alloys so treated in the final year of World War II were those made into forged cylinder heads of air-cooled aviation engines. Considerable bismuth was used in the production of atomic bombs, radar equipment, and undisclosed war uses.[3]

Bismuth consumed in the United States, 1943–45, by uses

[Figures compiled by War Production Board]

Use	1943		1944		1945	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Pharmaceuticals	985,544	49	585,193	40	839,458	51
Fabricating alloys	652,558	33	426,894	29	371,334	23
Ammunition solders	208,632	10	211,789	14	91,250	6
Fuse alloys	40,889	2	91,096	6	77,169	5
Aluminum alloys			8,315	1	58,107	3
Other [1]	116,768	6	142,353	10	197,975	12
Total consumption	2,004,391	100	1,465,640	100	1,635,293	100

[1] Principally rectifier coatings, nucleonics, and commercial solders.

[2] Smith, Walter C., Low-Melting Alloys as Production Aids: Metals and Alloys, vol. 22, No. 2, August 1945, pp. 397–402.

[3] Smith, Walter C., New Bismuth Alloys Developed to Find Market for the Metal: Min. and Met., vol. 26, No. 467, November 1945, pp. 561–562.

STOCKS

Stocks of bismuth metal held by producers, distributors, and consumers were reduced one-fourth in the spring of 1945. They were replenished in October, however, and by December 31 stocks were only 4 percent less than those of January 1.

Bismuth-metal inventories of Government-owned Office of Metals Reserve (successor to Metals Reserve Company July 1, 1945) gradually diminished from 958,991 pounds on January 1, 1945, to 762,829 pounds on December 31. The Government held no stocks of bismuth ore or concentrates during 1945.

PRICES

Since October 1939 and throughout 1945 metallic bismuth was quoted at $1.25 per pound, ton lots, according to E&MJ Metal and Mineral Markets. The prices of bismuth compounds were unchanged during 1942–45.

The London price of bismuth ore, 50 percent, c. i. f., per pound of contained Bi, was reduced from 4s. 6d. in January and February to 3s. 0d. for the remainder of 1945; on the other hand 30–35-percent are held at £110–£125 a long ton all year, according to the Metal Bulletin. Metallic bismuth, 99.95 percent, 5-cwt. lots, was quoted at 6s. 3d. per pound until a December raise to 6s. 8d. Bismuth matrix and bending alloys were steady at 4s. 6d. and 5s. 0d., respectively, during 1945.

TECHNOLOGY

Molybdenite was floated from bismuthinite, bismutite, and bismite by using xanthate as the collector, eucalyptus oil as the frother, and potassium bichromate as the conditioner. The feed contained 19 percent Bi and 11 percent MoS_2 and yielded concentrates of 43 percent and 93 percent, respectively.[4] The chemical reactions of bismuth and its compounds were catalogued.[5]

In-process materials at the copper-lead smelter of the Cerro de Pasco Copper Corp., Oroya, Peru, contain the following percentages of bismuth: Concentrates and byproduct roaster dusts comprising sinter feed, 0.43: finished sinter, 0.47; hot reverberatory Cottrell dust, 2.20; crude lead bullion, 1.12; and electrolytic lead refinery slimes, 13 percent. Treatment of the slimes is described by corporation engineers,[6] as follows:

> Bismuth-bearing slags from the converter and cupel operations are given a partial reduction in one of two 4- by 12-ft. oil-fired reverberatory furnaces. Partly reduced slag from this operation is returned to the converters, bismuth in slag being replaced by antimony from metal. Metal which contains 82 to 85 percent bismuth is transferred liquid to the kettle section for refining.
>
> Bismuth metal from the reverberatory operation is first given a caustic soda treatment for tellurium removal. Metal is then copper-drossed, the dross being matted with pyrite and coal. Matte is shipped to the copper circuit and metal

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[4] Hart, J. G., Separation of Molybdenite and Bismuthinite by Flotation: Chem. Eng. and Min. Rev. (Melbourne), vol. 37, No. 444, September 1945, p. 390.

[5] Jacobson, C. A. (ed.), Encyclopedia of Chemical Reactions: Reinhold Publishing Corp., New York, 1946, vol. 1, pp. 623–657.

[6] Fowler, W. W., Hanley, J. W., and Barker, I. L., Ore Reduction—Copper and Lead Smelting and Lead Refining: Min. and Met., vol. 26, No. 467, November 1945, pp. 545–558.

is returned to the kettle. After decopperizing, metal is desilverized by the Parkes process, the first or hot crusts being liquated and retorted, bismuth-bearing metal being returned to the bismuth circuit, and retort bullion entering the silver circuit. Metal is desilverized in two stages to ensure maximum purity. Lead and zinc are removed with chlorine in a cast-iron kettle. Chlorine tubes are of cast iron with pyrex glass inserts. About 24 hours is required for the operation and the end point is determined by a bar sample, which shows a distinct radial fracture when saturated with bismuth chloride; metal is then transferred into an air-sweep kettle for its removal. The metal is blown with air for about sixteen hours, the dross formed being returned to the de-leading kettle. The metal is then transferred to a casting kettle and given a final caustic soda treatment to ensure high purity. Cast bismuth assays 99.999 percent pure.

WORLD PRODUCTION

World production of bismuth approximated 1,100,000 kilograms (2,400,000 pounds) in 1945. The principal producers were United States, Peru, Canada, and Mexico.

World production of bismuth, 1940–45, by countries, in kilograms [1]

[Compiled by B. B. Waldbauer]

Country [1]	1940	1941	1942	1943	1944	1945
Argentina	4, 880	10, 040	13, 101	[2] 20, 900	(3)	[4] 24, 000
Australia (in ore) [5]	2, 800	2, 200	4, 800	6, 800	(3)	(3)
Bolivia (in ore and bullion exported) [6]	18, 700	22, 604	8, 896	12, 419	605	15, 337
Canada: Metal	18, 479	6	156, 605	184, 882	56, 188	95, 254
In bullion	8, 069	3, 401	1, 043	----------	----------	(3)
France (metal)	3, 000	30, 000	10, 000	(3)	(3)	(3)
Mexico (in impure bars)	185, 433	97, 971	128, 041	175, 055	165, 379	161, 368
Peru: Metal	387, 479	276, 907	373, 942	482, 920	416, 159	307, 500
In lead-bismuth alloy	56, 314	178, 138	16, 913	----------	----------	1, 500
Spain (metal)	10, 878	3, 900	15, 880	15, 198	5, 000	(3)
Union of South Africa (in ore)	(3)	332	167	1, 815	1, 635	(3)
United States	(7)	(7)	(7)	(7)	(7)	(7)
World production (estimate)	1, 400, 000	1, 400, 000	1, 700, 000	1, 400, 000	1, 200, 000	1, 100, 000

[1] Bismuth is believed to be produced also in Brazil, Burma, Chile, China, Germany, Japan, Norway, Rumania, Sweden, Uganda, U. S. S. R., United Kingdom, and Yugoslavia. Production figures are not available for these countries, but estimates by author are included in total.
[2] Content of ore exported to United States.
[3] Data not available. Estimate included in total.
[4] Estimate.
[5] Partly estimated. Excludes content of some bismuth-tungsten concentrates.
[6] Excludes bismuth content of tin concentrates exported.
[7] Production included in total; Bureau of Mines not at liberty to publish figure.

Australia.—Small quantities of bismuth ore have been mined as a byproduct of molybdenum and tungsten, principally at the Whipstock and Kingsgate mines, eastern New South Wales, and at the Biggenden mine, southeastern Queensland. The output was largely from Hatches Creek, central Northern Territory, in 1941–42. Since the closing of the Biggenden mine in 1937, it has been necessary to import about three quarters of Australia's bismuth requirements, and the bulk of it has been high-grade carbonate ore from China. The major lead, zinc, and copper deposits of Australia contain but minor quantities of bismuth. Lead concentrates from the Broken Hill district contain only 0.0003 percent Bi and the roasted and leached zinc concentrates only 0.0001 percent. Current annual consumption of bismuth is about 70,000 pounds, 95 percent made into medicinal salts by Bismuth Products Pty., Ltd., Sydney, and the remainder into various alloys.[7]

[7] Chace, Frederic M., The Mineral Industry of Australia: Bureau of Mines, Foreign Minerals Survey, vol. 2, No. 3, March 1945, pp. 101–102.

Germany.—German production of bismuth during World War II was typified by the rate in 1943, when 327 workmen mined 9,169 metric tons of ore and made a concentrate of 327 tons containing 17.6 percent Bi, 8.3 percent U_3O_8, 2.7 percent Co, and 0.6 percent Ni.[8]

Peru.—One of the world's largest producers of bismuth is the Cerro de Pasco Copper Corp., whose nonferrous metal properties and operations were comprehensively described in Mining and Metallurgy by officials of the corporation.[9] Their account of the refining of bismuth at Oroya is abstracted in the Technology section of this chapter.

Spain.—Production of bismuth concentrates during the first 9 months of 1945 totaled 33 metric tons compared with 39 metric tons in the corresponding period of 1944.[10] The tenor approximates 25 percent Bi.

Sweden.—The Boliden Mining Co. has resumed production of bismuth and is expected to provide Sweden's requirements of 10,000 kilograms a year.[11]

United Kingdom.—Imports of bismuth metal were 381.875 pounds in 1945 compared with 786,301 pounds in 1944 and 816,645 pounds in 1938.

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[8] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 2, Aug. 20, 1945, p. 12.

[9] Cerro de Pasco Copper Corporation, The Cerro de Pasco Enterprise: Min. and Met., vol. 26, No. 467, November 1945, pp. 509–574.

[10] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 1, Jan. 20, 1946, p. 8.

[11] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 4, Apr. 20, 1946, p. 5.

MAGNESIUM

By JOHN H. WEITZ AND MARY E. TROUGHT

SUMMARY OUTLINE

SUMMARY

Production of primary magnesium in the United States in 1945 totaled 32,792 short tons—79 percent less than in 1944 (157,100 tons). Decreasing demand for war purposes resulted in curtailment of operating facilities; by the end of 1945 all Government-owned plants had ceased production, and Dow Chemical Co. remained the only commercial producer.

Salient statistics of the magnesium industry in the United States, 1941–45

	1941	1942	1943	1944	1945
Production of primary magnesium [1] short tons	16, 295	48, 963	183, 584	157, 100	32, 792
Quoted price per pound [2] cents	22. 5	22. 5	20. 5	20. 5	20. 5
Exports [3] short tons	1, 549	4, 045	35, 631	21, 001	518
World production (estimated) do	72, 100	131, 400	283, 700	264, 400	60, 600

[1] Ingot equivalent.
[2] Lowest nominal price (New York) for primary metal ingot 99.8 percent pure, carlots.
[3] Magnesium metal, 1941–42; metal and alloys, 1943–45.

Magnesium sold or used in 1945 totaled 43,496 short tons, 70 percent less than the 1944 figure of 146,585 tons. Actual consumption of magnesium (based on an incomplete canvass) in the form of primary metal and alloy (excluding secondary) was 43,987 tons (magnesium content). Exports in the form of metal and alloys totaled 518 tons; imports were negligible.

World magnesium output is estimated at 55,000 metric tons in 1945, 77 percent less than the 239,900 tons produced in 1944.

PRODUCTION

Primary.—Output of primary magnesium in the United States in 1945 totaled 32,792 short tons (ingot equivalent), a decrease of 79 percent from the 157,100 tons produced in 1944. These figures represent the magnesium ingot produced directly from Dow-type electrolytic cells plus the magnesium ingot equivalent of the raw and crystal metal obtained from other processes of manufacture which experiences some loss when melted down into ingot form. The total output of all primary magnesium in the various forms, making no allowances for melting losses, was 33,106 tons in 1945 compared with 161,935 tons in 1944.

During 1945 magnesium was produced by seven plants, four of which were Government-owned. The Government-owned plants were the New England Lime Co. ferrosilicon-process plant at Canaan, Conn.; the Magnesium Reduction Co. ferrosilicon-process plant at Luckey, Ohio; the Diamond Magnesium Co. electrolytic, Dow-type plant at Painesville, Ohio; and the Dow Magnesium Corp. electrolytic (sea-water) plant at Velasco, Tex. The three privately owned plants operating during the year were the two Dow Chemical Co. plants in Texas and the Permanente Metals Corp. at Permanente, Calif. At the end of 1945 only the Dow Chemical Co. was producing magnesium. The sole potential competition to the Dow Co. apparent at the end of the year was Henry J. Kaiser's Permanente Metals Corp. plant, where the Hansgirg carbothermal process was used during the war. Kaiser announced in December that the company had repaid in full the $28,745,000 loan extended by Reconstruction Finance Corporation for construction of the plant. Experiments are reported to have been carried on during 1945 aimed at reducing operating costs from an estimated 30 cents a pound to half that figure. Certainly without a very substantial cut in costs the plant could not hope to compete in a market in which magnesium sells for 20.5 cents and in which capacity considerably exceeds demand.

Production, sales, exports, and apparent consumption of primary magnesium in the United States, 1941–45, in short tons

	Production		Sales	Exports [1]	Apparent consumption [2]
	Raw, crude, and pure ingot	Ingot equivalent			
1941	16,295	16,295	15,528	1,549	13,979
1942	(3)	48,963	47,420	4,045	43,375
1943	190,025	183,584	170,267	14,720	155,547
1944	[4] 161,935	[4] 157,100	146,585	4,830	141,755
1945	33,106	32,792	43,496	496	43,000

[1] Primary metal only. Alloy exports in addition: 20,911 tons in 1943; 16,171 tons in 1944; and 22 tons in 1945; corresponding data for 1941–42 unavailable.
[2] Does not consider fluctuations in consumers' stocks and metal derived from scrap. Withdrawals from producers' stocks totaled 10,704 tons in 1945; additions to producers' stocks totaled 767 tons in 1941; 1,543 tons in 1942; 13,317 tons in 1943; and 10,515 tons in 1944
[3] Not available.
[4] Does not include magnesium content of incendiary mixture produced direct.

Dow Chemical Co., again in 1945 the sole producer of magnesium, owns outright 36,000,000 pounds of annual capacity at Midland, Mich., and Freeport, Tex. In addition, the company holds a right of first refusal on the Government-owned part of the Freeport plant and on the Velasco, Tex., plant, both of which are designed to process sea water.

At the end of 1945 no negotiations had been concluded for the sale of any of the Government plants, although some interest had been shown in several of them, chiefly as possible chemical-producing units.

The Surplus Property Administration recommended late in 1945 that 6 of the 13 Government-owned plants be held in operating or stand-by condition and that the remaining 7 be disposed of, perhaps through adapting them to other uses. The 6 plants recommended for stand-by lease, or sale as magnesium facilities, are the following: Freeport, Tex. (18,000 short tons annual capacity); Velasco, Tex. (36,000-ton capacity); Painesville, Ohio (18,000-ton capacity); Luckey, Ohio (5,000-ton capacity); Spokane, Wash. (24,000-ton capacity); and Canaan, Conn. (5,000-ton capacity). If this recommendation is carried out the effective magnesium-producing capacity of the United States will be approximately 136,000 short tons a year compared with a wartime peak capacity of 293,000 tons.

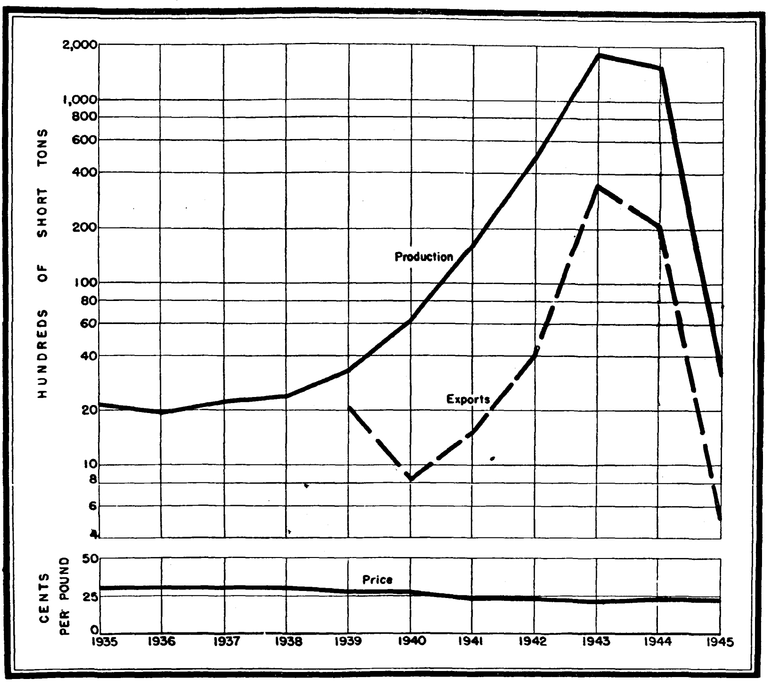

FIGURE 1.—Trends in production, exports, and quoted price of primary magnesium, 1935–45.

Secondary.—Recovery of secondary magnesium, including alloying ingredients, totaled 9,247 short tons (including secondary magnesium incorporated in primary magnesium ingot) in 1945 (14,185 tons in 1944) and required the consumption of 10,650 tons of magnesium scrap, 91 percent of which was new scrap. Of the quantity of magnesium recovered, 7,359 tons were as ingot and 496 tons went into castings, 864 tons into magnesium-alloy shapes, 274 tons into aluminum alloys, 13 tons into other alloys, and 241 tons into chemicals and incendiary products. Additional information of secondary magnesium will be found in this volume in the chapter on Secondary Metals—Nonferrous.

CONSUMPTION AND USE

The largest share of the magnesium consumed by industry during 1945 was used for war purposes—incendiaries, aircraft parts and accessories, rocket launchers, flares, and tracers. Consumption of the metal for war uses dropped sharply after the surrender of Germany and even more sharply after the Japanese capitulation; civilian uses were a very small share of total use. Apparent consumption of pure primary magnesium, calculated by subtracting exports from sales, totaled 43,000 tons in 1945 compared with 141,755 tons in 1944, a decrease of 70 percent.

A canvass measuring actual consumption was conducted in 1945, as in the preceding year; but, owing to the fact that many companies were unable to furnish the data requested, the statistics are incomplete. Actual domestic consumption totaled 43,987 short tons in 1945, a decrease of 67 percent from the 132,698 tons consumed in 1944. Of the 43,987 tons used, 31,641 tons (72 percent) were consumed in making structural products (castings, sheet, structural shapes, and forgings); and 12,346 tons or 28 percent were consumed in other products, including powder, alloys with other metals, and miscellaneous uses. Castings, largely sand and die, was the largest single use for the metal, taking 27,515 tons or 63 percent of the total. Sand castings accounted for the use of more than twice as much metal as permanent mold castings, whereas in 1944 more magnesium was used in permanent mold castings.

Actual domestic consumption of primary magnesium (ingot equivalent and magnesium content of magnesium-base alloys) in 1944–45, by uses

Product	1944	1945 [1]	Product	1944	1945 [1]
Structural products:			Other products:		
Castings:			Powder	9,080	4,769
Sand	44,773	18,405	Aluminum alloys	6,868	5,589
Die	1,165	803	Other alloys	12	24
Permanent mold	59,181	8,307	Scavenger and deoxidizer	159	228
Sheet	1,543	1,517	Chemical	156	182
Structural shapes, rods, tubing (extrusions)	4,784	2,452	Other [2]	4,633	1,554
Forgings	344	157	Total other products	20,908	12,346
Total structural	111,790	31,641	Grand total	132,698	43,987

[1] Owing to lack of returns from a number of companies, figures are incomplete.
[2] Includes primary metal consumed in making secondary alloy.

PRICES

Throughout 1945 the base price of standard four-notch primary magnesium ingot remained at 20.5 cents a pound. On August 30, 1945, the Office of Price Administration announced that price controls on primary and secondary magnesium and magnesium scrap were suspended, but this had no effect on prices during the remainder of the year. Also suspended were controls over magnesium castings, formerly subject to Maximum Price Regulation 125, which were used mainly for aircraft and other military items. Controls over magnesium strip, sheet, tube, and rod remained in effect.

FOREIGN TRADE [1]

Imports of magnesium in 1945 in all forms, all of which came from Canada, totaled 20,308 pounds (10 tons) valued at $3,768 and consisted of 14,561 pounds of metal and scrap, 15 pounds of magnesium alloy, and 5,732 pounds of powder.

Exports of magnesium from the United States, 1944–45

	1944		1945	
	Short tons	Value	Short tons	Value
Magnesium metal in primary form	[1] 21,001	$9,799,833	[2] 518	$216,793
Magnesium metal in other forms	1,597	987,048	140	292,430
Magnesium powder	1,600	2,301,293	720	579,736

[1] Includes 16,171 tons of magnesium-base alloy.
[2] Includes 22 tons of magnesium-base alloy.

Exports of magnesium in primary form decreased from 21,001 tons in 1944 to 518 tons in 1945, a drop of 98 percent; large decreases in exports of metal in other forms, and of powder, were also recorded. Of the metal in primary form, 280 tons went to U. S. S. R., 210 tons to Mexico, 22 tons to Sweden, and 2 tons or less each to nine other countries. Canada received 84 tons of the magnesium metal exported in other forms, U. S. S. R. 48 tons, and other countries 8 tons. The magnesium powder exports were distributed as follows: United Kingdom 554 tons, Canada 91 tons, Brazil 73 tons, and Mexico 2 tons.

In 1945, exports of magnesium metal in primary form were equivalent to about 2 percent of the total domestic production compared with 13 percent in 1944.

GOVERNMENT REGULATIONS

Magnesium, which was virtually free of use restrictions after revocation of War Production Board Preference Order M–2–b and the simultaneous issuance of Order M–2–c in October 1944, was made entirely free of restrictions as to use when Order M–2–c was revoked on July 24, 1945. This order had required the filing of monthly reports with WPB and had made requests for delivery of magnesium subject to the various priorities regulations.

WORLD PRODUCTION

The world output of primary magnesium declined sharply in 1945 to an estimated 55,000 metric tons, compared with 239,900 tons in 1944, a decrease of 77 percent. The largest drop from a tonnage standpoint was in the United States, but the percentage decrease was perhaps greater among the Axis nations. Data on which to base estimates for individual countries were so meager in 1945 that estimates were omitted, except for four countries in the table. As a result of cut-backs as World War II was drawing to an end, production fell to its lowest level since 1940.

Canada.—The ferrosilicon-process plant at Haley's Station was purchased from the Dominion Government in the middle of 1945 for a reported price of $1,400,000, of which $100,000 was the down pay-

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Estimated world production of magnesium, 1940–45, by countries, in metric tons

	1940	1941	1942	1943	1944	1945
Australia		200	430	800	900	(1)
Canada [2]		5	367	3,245	4,799	3,380
France [2]	2,562	1,908	1,332	1,741	842	(1)
Germany	20,100	25,000	35,000	40,000	50,000	(1)
Italy	[2] 438	[2] 1,504	[2] 2,494	2,800	3,000	(1)
Japan	4,000	8,000	12,000	15,000	17,000	(1)
Norway		100	2,000	2,000	2,000	(1)
Switzerland	750	700	1,500	1,500	1,000	(1)
U. S. S. R.	1,500	4,000	5,000	5,000	5,000	2,170
United Kingdom [2]	1,510	9,232	14,630	18,794	12,887	6,000
United States [2]	5,680	14,782	44,418	166,544	142,518	29,748
Total	36,500	65,400	119,200	257,400	239,900	55,000

[1] No data available. Estimates included in total.
[2] Actual production.

ment. The balance is to be retired in annual payments equal to 1 cent a pound for metal produced but not less than $50,000 a year with interest of 3¼ percent on the outstanding principal. In addition, the purchasing company has agreed to spend at least $500,000 in the next 2 years to make improvements and install additional facilities. Total capital expenditure by the Government was $3,448,062. The plant recovered over 12,000 short tons of metal from August 1942 to June 30, 1945, from the 146,913 tons of dolomite treated in that period. Substantial stocks of magnesium were reported to have been built up before the plant was closed, enabling shipments to be continued while alterations were in progress. Operations were expected to be resumed in 1946.

France.—Production of magnesium was resumed in France during 1945, and output was reported to be about 50 tons a month by the end of the year.

Germany.—Late in 1945 primary magnesium production in Germany was banned for an indefinite period by agreement among France, Great Britain, Russia, and the United States. Thus Germany, which was until 1942 the leading producer of magnesium, is no longer a factor in the industry.

United Kingdom.—Consumption of magnesium in the United Kingdom was sharply reduced in the latter half of 1945. As recorded in the Monthly Digest of Statistics, the monthly average consumption dropped from 1,160 tons in the first half of the year to 460 tons in the third quarter and to 130 tons in November. It is stated by British sources that only about 65 percent of total requirements during the war was filled by domestic production. Use of magnesium was principally in aircraft castings and incendiary bombs; only a very small percentage of the total was consumed in the production of sheet, forgings, and extrusions. By the end of 1945 only the Clifton Junction plant of Magnesium Electron, Ltd., and the Swansea plant of Magnesium Metal Corp. were in operation.

On August 1, 1945, the Government removed some of the controls over magnesium to grant licenses to users under which they were free to purchase and use the metal in any desired amount, for any purpose, and from any supplier. The price for magnesium ingot remained at £168 a long ton, which is equivalent to about 30 cents a pound.

ANTIMONY

By Thomas P. Wootton

SUMMARY OUTLINE

SUMMARY

Government control under War Production Board General Preference Order M–112 was increased, effective February 10, 1945, after antimony had been available without allocation for more than a year. This order required reports and formal allocation requests to be filed monthly by possessors or purchasers of more than 2,240 pounds of antimony contained in any commercial product. On May 12 the order was amended to require requests from consumers wanting to purchase more than 224 pounds (antimony content) at any one time, but the allowable inventory remained at 2,240 pounds. This order remained in effect throughout the year.

Domestic production of antimony contained in ores and concentrates was the lowest in 4 years. Antimony imported for consumption as metal and contained in ore increased one-third to a total of 23,270 tons. Industry-owned stocks were up slightly; but both Government and mine stocks declined sharply, leaving a net decrease of 17 percent from 26,322 tons to 21,958.

The Office of Price Administration ceiling price of American antimony metal in less than carlots remained 15.84 cents a pound for its second full year. The average price in previous years was: 1943, 15.92 cents a pound; 1942, 15.55; 1941 and 1940, 14.00. The price of antimony ores and concentrates ranged from \$2.10 to \$2.30 a short-ton unit for material ranging from 50 to 65 percent antimony.

Figure 1 is a graphic presentation, insofar as data are available, of world production, United States imports, and New York price.

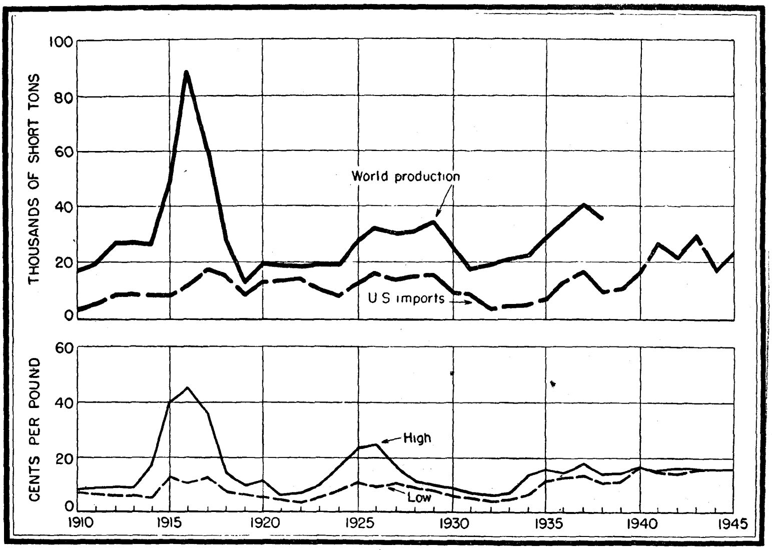

FIGURE 1.—Trends in world production, 1910–38, and United States imports and range in New York price of antimony, 1910–45.

Salient statistics for antimony in the United States, 1941–45

	1941	1942	1943	1944	1945
Production of antimony ore and concentrates short tons	3,460	6,980	16,785	13,501	14,966
Antimony contained do	1,214	2,944	5,556	4,735	1,930
Antimony content of antimonial lead produced from domestic and foreign ores short tons	2,958	3,267	2,085	2,857	1,992
Secondary antimony produced do	21,629	18,200	15,483	15,886	17,148
Imports for consumption:					
Antimony in ore do	19,386	20,946	28,755	17,080	22,643
Needle or liquated antimony do	638	522	1		
Metal do	7,469	127	932	293	627
Oxide and other compounds do	2	(1)	(1)		
Exports of antimony ore, metal, and compounds short tons	2 70	230	494	1,319	333
Consumption of primary antimony do	3 29,994	3 23,852	19,508	23,756	25,761
Stocks of antimony in bonded warehouse at end of year short tons	416	(4)	(4)	(4)	(4)
Average price of antimony at New York: 5					
Chinese cents per pound	6 16.50	6 16.50	6 16.50	6 16.50	6 16.50
American do	14.00	15.55	15.92	15.84	15.84
World production short tons	7 43,700	7 47,500	7 47,300	7 32,000	(4)

1 Less than 1 ton.
2 Includes only foreign metal.
3 Primary antimony available for consumption; data not strictly comparable with figures for subsequent years.
4 Figures not available.
5 According to American Metal Market.
6 Nominal.
7 Estimate.

DOMESTIC PRODUCTION

MINE PRODUCTION

In 1945 only 8 mines—3 each in Idaho and Nevada and 2 in Oregon are known to have produced antimony ores and concentrates, compared with 11 in 1944 and 17 in 1943. Although gross tonnage increased slightly from 13,501 to 14,966, antimony content dropped nearly 60 percent from 4,735 to 1,930. Most of this was contained in concentrates recovered from ores mined primarily for other metals, such as gold and tungsten. Only 32 tons of the metal were contained in ores mined solely for their antimony. Of the United States total mine production of antimony, 97 percent came from the complex ores of Shoshone and Valley Counties, Idaho.

Alaska.—No production of antimony ores or concentrates was reported from Alaska for the year 1945. Past production has come from the Stampede and Slate Creek mines in the Kantishna district.

Idaho.—As in the past, the mines of Shoshone and Valley Counties yielded most of the antimony obtained from domestic sources. The Bradley Mining Co. Yellow Pine gold-tungsten-antimony mine in Valley County produced most of the United States total mine output followed by the Sunshine Mining Co. Sunshine mine and the Coeur d' Alene Mines Corp. Mineral Point mine, both in Shoshone County.

Nevada.—Three operators in Elko, Lander, and Nye Counties produced 65 tons of antimony ore containing 22 tons of antimony, a decrease of about 25 percent in metal content from the previous year's output.

Oregon.—Only two antimony mines are known to have been operated in Oregon in 1945. Anthony Brandenthaler shipped several cars of gold-antimony ore to Midvale, Utah, from his Gray Eagle mine in Baker County, and Bert B. Lowry & Sons shipped a car of antimony ore from its property in Jackson County.

SMELTER PRODUCTION

Primary.—Smelter output of primary antimony as metal and contained in the oxide and sulfide increased 5 percent to 21,000 tons. Separate figures on these 3 primary and intermediate products cannot be published. This production came from 11 plants, including 1 new enterprise and 1 plant the output from which was previously reported with that of another plant owned by the same company. These reduction works consumed 23,200 tons of antimony in raw materials, including 18,500 tons in ores and concentrates.

The Texas Mining & Smelting Co., Laredo, Tex., continued to be the dominant factor in domestic metal production but was surpassed by one and nearly equaled by two other firms in output of the oxide. The Texas plant operates almost entirely on oxide and mixed oxide-sulfide ores imported from Mexico.

Other plants producing antimony metal in 1945 were those of the Bunker Hill & Sullivan Mining & Concentrating Co., Kellogg, Idaho; Harshaw Chemical Co., El Segundo, Calif.; and the Defense Plant Corporation, Glen Cove, Long Island, N. Y. The latter began operations in September, using imported ores supplied by the office of Metals Reserve (successor to Metals Reserve Company, November 3). The plant is operated for the Government by the Wah Chang Trading Corp. of New York. The Sunshine Mining Co.'s plant at Kellogg, Idaho, remained idle throughout the year.

Antimony oxide also was produced from ores, concentrates, and metal by the American Smelting & Refining Co., at Omaha, Nebr., and Perth Amboy, N. J.; Harshaw Chemical Co., at El Segundo, Calif., and Elyria, Ohio; McGean Chemical Co., at Cleveland, Ohio; and Metal & Thermit Corp., at Carteret, N. J.

Sulfides of antimony, including the black needle or liquated sulfide and the chemically precipitated golden and crimson material, were produced from chemical-grade sulfide ore and from the oxide by Rare Metal Products Co. at Belleville, N. J., by Harshaw at Philadelphia, and by McGean.

Production of antimonial lead in 1945 at domestic primary lead refineries declined slightly to 56,495 tons containing 4,148 tons (7.3 percent) of antimony. The contained antimony was derived as follows: From domestic ores 42 percent, from foreign ores 6 percent, and from scrap 52 percent. Details are shown in the accompanying table, and a fuller discussion will be found in the chapter of this volume on Lead.

Antimonial lead produced at primary lead refineries, 1941–45, in short tons

Year	Production	Antimony content				
		From domestic ores [1]	From foreign ores [2]	From scrap	Total	
					Quantity	Percent
1941	40,237	2,586	372	552	3,510	8.7
1942	51,762	2,396	871	257	3,524	6.8
1943	63,515	1,591	494	1,286	3,371	5.3
1944	57,902	2,015	842	1,813	4,670	8.1
1945	56,495	1,749	243	2,156	4,148	7.3

[1] Includes primary residues and small quantity of antimony ore.
[2] Includes foreign base bullion and small quantity of foreign antimony ore.

Secondary.—Recovery of antimony in antimonial lead and other alloys from scrap at secondary smelters and by remelters in 1945 amounted to 17,148 tons, an increase of 8 percent over the 15,886 tons similarly recovered in 1944. This quantity plus the 25,761 tons of antimony contained in primary materials put in process (but not necessarily recovered—see Consumption and Uses) totals 42,909 tons, which is also an increase of 8 percent over the comparable figure (39,642 tons) for 1944. Plates, grids, and sludge from discarded storage batteries continued to be the main source of secondary antimony. A detailed review will be found in the chapter of this volume on Secondary Metals—Nonferrous.

PRODUCTION BY MANUFACTURERS

It is very difficult to obtain a true picture of the total output of such metallic antimony-containing products as alloys for bearings, batteries, type, and cable coverings and such nonmetallic products as flameproofed textiles, paints, and ceramic enamels. However, due to Government controls and allocation procedures, it is possible to measure the antimony content of raw materials put in process in the manufacture of these items or in the manufacture of the intermediate products customarily used in producing them. Therefore, a discussion of the raw materials consumed in the manufacture of these metallic and nonmetallic products appears below under Consumption and Uses.

CONSUMPTION AND USES

Primary antimony content of ores and concentrates and antimony metal, oxide, and sulfides consumed in the manufacture of 10 metallic and 9 nonmetallic items for 1943–45, is shown in the accompanying table. The figures were compiled from monthly applications filed with the Civilian Production Administration by more than 400 operators asking for allocations of antimony raw materials for use in manufacturing the various items listed. No record is kept of the stocks, production, and shipments of those items, and the metallurgical losses are not reported. The table merely records the fact that 25,761 tons of antimony contained in the raw materials mentioned were consumed during the year in the process of manufacturing the 19 items.

Industrial consumption of primary antimony, 1943–45, in short tons

[Antimony content of raw materials, including ores and concentrates, metal, oxide, and sulfides, put in process]

Product	Antimony consumed in the manufacture of products listed		
	1943	1944	1945
Metal products:			
Antimonial lead	2,889	5,287	5,920
Bearing metal and bearings	1,563	2,637	2,825
Battery metal and battery parts	2,400	2,341	1,273
Type metal and type	856	841	1,243
Cable covering	447	422	275
Sheet and pipe	176	326	368
Castings	198	115	267
Collapsible tubes and foil	132	114	203
Ammunition	389	93	107
Solder	129	71	125
Total metal products	9,179	12,247	12,606
Nonmetal products:			
Flameproofed textiles	6,952	7,063	7,675
Paints and lacquers	1,859	2,490	3,062
Frits and ceramic enamels	281	501	936
Glass and pottery	537	411	304
Sodium antimonate	47	369	512
Antimony trichloride	153	289	207
Ammunition primers	97	43	66
Matches	18	10	18
Other	385	333	375
Total nonmetal products	10,329	11,509	13,155
Grand total	19,508	23,756	25,761

Consumption of antimony in the manufacture of all the major items except battery metal and parts increased sharply. The rise in consumption for making metal products was 3 percent and for nonmetal products 14 percent; the total amounted to a little more than 8 percent. Continued war demand is reflected in the increased use of antimony in producing several items, particularly paints and compounds for flameproofing textiles, and the beginning of reconversion in the last part of the year is shown by the figures on type metal, collapsible tubes and foil, ceramic materials, and matches. The use of metallic antimony and liquated antimony sulfide in making ammunition, including primers, was almost entirely for civilian sporting cartridges, inasmuch as the armed forces' small arms ammunition program was well on the way toward completion before the beginning of 1945.

STOCKS

Stocks of the antimony raw materials—ores and concentrates, metal, oxide, and sulfides—held as mine stocks, by industry and in Government stock piles, declined 17 percent from 26,332 to 21,958 short tons of contained antimony. Details, including net receipts and consumption of ores and concentrates by smelters and manufacturers, are shown in the accompanying tables.

Stocks of antimony in ores and concentrates held by smelters and manufacturers on December 31, 1945, were greater than at the end of the previous year by nearly 40 percent. Government stocks increased 11 percent, but mine stocks declined 34 percent, making a net gain of slightly more than 1 percent. Antimony content of oxide on hand increased 25 percent, due largely to cancellation of Army and Navy contracts for flameproofing compounds and fire-retardant paints, while the small stocks of antimony sulfides dropped 13 percent. The significant change, however, was the 54-percent decrease in total stocks of antimony metal. This was brought about by the heavy demand for oxide in the early months of the year, when the lack of suitable ores necessitated the production of oxide from metal, most of which was drawn from Government stocks.

Antimony ores and concentrates at smelters and manufacturers in 1945, in short tons of contained antimony

Raw materials	Stocks on [1] Dec. 31, 1944	Net receipts	Consumption	Stocks on Dec. 31, 1945
Chemical-grade sulfide ore	794	7,055	6,914	935
Metallurgical-grade sulfide ore	405	5,552	5,050	907
Mixed or oxide ore	990	9,216	9,706	500
Sulfide concentrates	855	4,123	3,074	1,904
Total ore	3,044	25,946	24,744	4,246

[1] Revised figures.

Stocks of primary and intermediate raw materials in the United States at year end, 1944–45, in short tons of contained antimony

Item	Dec. 31, 1944				Dec. 31, 1945			
	Industry	Government	Mine	Total	Industry	Government	Mine	Total
Ores and concentrates	[1] 3,044	6,862	5,114	15,020	[1] 4,246	7,592	3,364	15,202
Metallic antimony	3,004	6,177		9,181	1,636	2,554		4,190
Antimony oxide	1,893			1,893	2,277	91		2,368
Antimony sulfide (needle and precipitate)	228			228	198			198
	8,169	13,039	5,114	26,322	8,357	10,237	3,364	21,958

[1] From preceding table.

PRICES

The Office of Price Administration New York price of domestic brands of antimony metal, 99.5 percent minimum, in less than carlots remained 15.84 cents a pound and of Chinese brands (duty paid), 16.50 cents (nominal), throughout the year. Likewise, the price of domestic metal in bulk, f. o. b. Laredo, Tex., was unchanged from 14.50 cents. The London price of metal, 99 percent minimum, was lowered to £105 a long ton (from £120), effective January 1, 1945, and was unchanged at that level throughout the year.

According to E&MJ Metal and Mineral Markets, New York quotations on antimony ores and concentrates were stable at $2.10 to $2.20 a short-ton unit for the 50- to 55-percent grade; $2.15 to $2.20 for 58- to 60-percent; and $2.20 to $2.30 for 60- to 65-percent, The London price for 60-percent sulfide ore was 11s. a long-ton unit at the beginning of the year, rose to 11s. 9d. in June, and closed at 13s. 6d.

Average monthly quoted prices of antimony, prompt delivery at New York, 1941–45, in cents per pound, for less than carlots

Month	Chinese brands (duty paid)[1]					American brands[2]				
	1941[3]	1942[3]	1943[3]	1944[3]	1945[3]	1941	1942	1943	1944	1945
January	16.50	16.50	16.50	16.50	16.50	14.00	14.00	16.05	15.84	15.84
February	16.50	16.50	16.50	16.50	16.50	14.00	14.00	16.05	15.84	15.84
March	16.50	16.50	16.50	16.50	16.50	14.00	14.62	16.05	15.84	15.84
April	16.50	16.50	16.50	16.50	16.50	14.00	15.90	16.05	15.84	15.84
May	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.94	15.84	15.84
June	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
July	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
August	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
September	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
October	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
November	16.50	16.50	16.50	16.50	16.50	14.00	16.01	15.84	15.84	15.84
December	16.50	16.50	16.50	16.50	16.50	14.00	16.02	15.84	15.84	15.84
Average	16.50	16.50	16.50	16.50	16.50	14.00	15.55	15.92	15.84	15.84

[1] From daily issues of American Metal Market.
[2] Metal Statistics, 1946, p. 581.
[3] Nominal.

FOREIGN TRADE[1]

The following four tables give detailed information on the imports and exports of antimony materials for 1941 through 1945.

Antimony imported for consumption in the United States, 1941–45

Year	Antimony ore			Needle or liquated antimony		Antimony metal		Antimony oxides and other compounds	
	Short tons	Antimony content: Short tons	Antimony content: Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	41,662	19,386	$2,717,472	638	$126,018	7,469	$2,056,678	2	$537
1942	50,033	20,946	3,943,402	522	101,164	127	28,904	(1)	5
1943	63,187	28,755	5,351,852	1	172	932	267,916	(1)	3
1944	41,879	17,080	2,721,690			293	105,667		
1945	49,385	22,643	4,644,859			627	181,559		

[1] Less than 1 ton.

Imports of antimony metal rose to 627 tons, an increase of 114 percent over the previous year and the largest quantity received since the record year 1941, and imports of antimony contained in ore increased 33 percent to 22,643 tons.

Receipts of ore from Bolivia were nearly trebled but were still 2,500 tons below those of the record year 1943. For the first time since 1941, an appreciable quantity of metal was imported from China. Imports of ore from Mexico were the lowest recorded in several years, and no metal at all came from that country. A small shipment of metallurgical-grade ore was received from the Union of South Africa.

The gross weight of domestic antimony materials exported in 1945 was 333 tons, of which 250 tons were ores and concentrates and 83 tons metal and alloys.

Reexports of foreign metal and alloys totaled 463 tons, gross weight. There were no reexports of foreign ores and concentrates.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Antimony imported into the United States, 1944–45, by countries, in short tons [1]

Country	Antimony ore			Antimony metal	
	Gross weight (short tons)	Antimony content		Short tons	Value
		Short tons	Value		
1944					
Bolivia	7,235	4,450	$865,408		
Chile [2]	774	485	91,816		
China				(3)	$7
Honduras [4]	166	106	15,421		
Mexico	31,851	11,087	1,564,455	220	87,803
Peru	1,446	752	130,791	74	17,857
	41,472	16,880	2,667,891	294	105,667
1945					
Bolivia	18,970	11,348	2,292,401		
Chile [2]	2,503	1,564	313,141		
China				571	168,228
Honduras	31	17	3,676		
Mexico	25,146	8,303	1,779,770		
Peru	2,781	1,443	240,088	56	13,329
Union of South Africa	112	61	11,960		
	49,543	22,736	4,641,036	627	181,557

[1] Data include antimony imported for immediate consumption plus material entering the country under bond.
[2] Probably mined in Bolivia or Peru and shipped from a port in Chile.
[3] Less than 1 ton.
[4] Includes 77 tons of ore containing 48 tons of antimony in 1944 mined in Honduras but credited by the U. S. Department of Commerce to Guatemala.

Estimated antimony content of type metal, antimonial lead, and other alloys imported for consumption in the United States, 1941–45, in short tons [1]

Year	Type metal and antimonial lead	Other alloys [2]	Total	Year	Type metal and antimonial lead	Other alloys [2]	Total
1941	202		202	1944	388		388
1942	35		35	1945	1,379		1,379
1943	281		281				

[1] For details of gross weight and values, see imports shown in Lead chapter of this volume.
[2] Chiefly in special antimony-lead alloys containing high percentage of antimony.

Foreign antimony (regulus or metal) exported from the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	70	$19,690	1944	18	$5,445
1942	(1)	181	1945	463	141,301
1943	(1)	200			

[1] Less than 1 ton.

WORLD PRODUCTION

The accompanying table presents available data on all the important antimony-producing countries of the world. Information not obtained in time to be included in Minerals Yearbook, 1944, has been compiled for several countries, including Algeria, Australia, and Italy. Figures on the output of Chinese mines have been revised on the basis of an official report [2] recently received. The world total for 1939–44 has been estimated although information is still lacking on the output of several countries, most of them small producers.

[2] Statistical Abstract of the Republic of China, Chungking, Apr. 10, 1945, pp. 38–39.

World production of antimony, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
North America:								
Canada	34	[2] 550	1,083	1,329	1,269	465	809	701
Honduras	--------	--------	([3])	23	103	110	65	11
Mexico [4]	7,391	7,243	11,286	10,241	10,759	12,585	10,056	8,053
United States	542	328	412	1,013	2,457	4,638	3,952	1,611
South America:								
Argentina	174	97	91	123	41	100	([3])	([3])
Bolivia (exports)	8,682	9,255	10,813	13,680	16,231	16,536	6,852	5,093
Peru	753	775	809	1,440	1,457	2,472	932	655
Europe:								
Czechoslovakia	[2] 800	[2] 1,012	[2] 1,104	1,645	[2] 3,130	([3])	([3])	([3])
France	--------	--------	--------	--------	128	153	107	143
Germany (Austria)	145	102	184	26	391	([3])	([3])	([3])
Greece	--------	1	([3])	([3])	([3])	([3])	([3])	([3])
Italy	851	674	630	819	667	([3])	([3])	270
Portugal	131	174	247	46	([3])	[2] 115	[2] 39	([3])
Spain	--------	22	3	101	210	176	122	([3])
Yugoslavia	2,739	3,337	[2] 4,800	([3])	([3])	([3])	([3])	([3])
Asia:								
Borneo, British	--------	14	41	([3])	([3])	([3])	([3])	([3])
Burma	84	([3])	([3])	([3])	([3])	([3])	([3])	([3])
China [5]	9,436	12,017	8,469	7,989	3,510	428	[6] 596	([3])
India, British	11	([3])	([3])	([3])	([3])	([3])	([3])	([3])
Indochina	83	19	9	([3])	([3])	([3])	([3])	([3])
Iran [7]	([3])	([3])	([3])	1	19	([3])	18	([3])
Korea (Chosen)	6	([3])	([3])	([3])	([3])	([3])	([3])	([3])
Turkey (Asia Minor)	398	460	128	5	600	8	58	--------
Africa:								
Algeria	744	224	276	478	328	184	136	([3])
Morocco:								
French	125	420	427	177	235	396	150	124
Spanish	107	54	67	85	144	153	22	144
South Rhodesia	63	50	[8] 116	[8] 93	[8] 155	[8] 167	([3])	([3])
Union of South Africa	10	6	126	445	990	1,560	2,400	[9] 1,540
Oceania:								
Australia:								
New South Wales	67	37	44	147	207	196	163	([3])
Queensland	8	--------	8	25	11	6	11	([3])
Victoria	195	100	14	15	6	--------	236	11
Western Australia	316	340	247	289	826	690	15	--------
New Zealand	1	--------	1	8	([3])	--------	--------	([3])
	33,900	37,400	41,600	43,700	47,500	47,300	32,000	--------

[1] Approximate recoverable metal content of ore produced, exclusive of antimonial lead ores; 92 percent of reported gross content is used as basis for calculations in nearly every instance. Japan produces antimony, but data on production are not available.
[2] Estimate.
[3] Data not available; an estimate for 1938–44 has been included in the total.
[4] Includes antimony content of antimonial lead.
[5] Production of Free China.
[6] January to June, inclusive.
[7] Fiscal year ended Mar. 20 of year stated.
[8] Exports.
[9] January to September, inclusive.

REVIEW BY COUNTRIES

Australia.—The following notes on the Australian antimony industry have been abstracted from a report [3] issued by the Foreign Minerals Division of the Bureau of Mines in 1945 but classified as confidential until recently.

Antimony is recovered from high-grade ore and sulfide concentrates produced at antimony mines, from gold-antimony concentrates produced at gold mines, and from antimonial slag produced at lead refineries. This output comes from the mines of Western Australia, New South Wales, Victoria, and Queensland. Some of the metal is recovered as antimonial lead from lead concentrate and also from residues from the treatment of zinc concentrates produced from the

[3] Bureau of Mines, The Mineral Industry of Australia; Foreign Minerals Survey, vol. 2, No. 3, March 1945, p. 100.

ores of the Broken Hill district, New South Wales, and Rosebery, Tasmania. Needle or liquated antimony sulfide is produced from hand-picked stibnite by O. T. Lempriere & Co., Ltd., at its Sydney, N. S. W., plant. At the same plant, stibnite concentrates are treated for the recovery of metallic antimony, antimony oxide, and sodium antimonate.

Bolivia.—All Bolivian antimony enters world trade in the form of hand-sorted sulfide ore averaging about 60 percent antimony. It is produced by a few large and many small operators, mainly in the Departments of Oruro and Tupiza, and is marketed through Banco Minero de Bolivia.

France.—All antimony ores obtained from French mines in 1945 were used in the manufacture of antimony oxide. About one-half the domestic demand for antimony metal was met by imports, and the remainder of the metal used was smelted from ores imported from Algeria and French Morocco.

Germany.—According to a report issued by the Joint Intelligence Objectives Agency,[4] only one plant in Germany smelts antimony ore for the production of refined metallic antimony. This is the Herzog Julius Smelter at Goslar, in the Harz Mountains. It consumes annually about 2,000 tons of sulfide ores containing 40 percent antimony and 2 percent arsenic. These ores, imported from Austria, Hungary, and Slovakia, are smelted in a rotary furnace, from which 70 percent of the antimony in the charge is recovered as metal (subsequently refined in a reverberatory furnace), 20 percent in baghouse dust, and the remainder in a slag containing 10 to 12 percent antimony. Dust is returned to the furnace, and the slag is mixed with low-grade ores (8 to 10 percent antimony) and smelted in a shaft furnace. In 1944 the total recovery was 98 percent.

Honduras.—A small quantity of sulfide concentrates has been exported from Honduran mines annually, beginning in 1941. The following brief description is quoted from a recent Bureau report:[5]

> * * * Antimony is produced on a small scale in Honduras, mostly from the El Quetzal mine, near San Augustin de Copan, owned by Srs. Manuel Bueso and Rudolfo Nater. A stibnite concentrate averaging 58 to 62 percent antimony is derived from ore mined from open cuts and is exported to the United States via San Jose, Guatemala. Minor production comes from La Union mine in the Department of Olancho and at least four other small properties. * * *

Mexico.—Mexico is the second most important source of antimony in the Western Hemisphere, ranking next to Bolivia in total output in recent years but leading that country in 1944 and 1945. During the war years the entire output was exported to the United States, where most of it was treated by the Texas Mining & Smelting Co. at Laredo. The most important deposits are in the States of San Luis Potosí, Oaxaca, and Guerrero. Descriptions[6] of two of these deposits have been published in recent months.

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[4] Phillips, Albert J., Copper, Lead, Zinc, Tin and Antimony Smelting and Refining in Northwestern Germany: Office of Military Government for Germany (U. S.), Fiat Final Report No. 229, Oct. 2, 1945, pp. 41–42.

[5] Minerals Review of Latin America, 1939–44: Foreign Minerals Survey, vol. 2, No. 4, Oct. 1945, p. 74.

[6] McAllister, James F., and Ortiz, David Hernandez, Quicksilver-Antimony Deposits of Huitzuco, Guerrero, Mexico: Geol. Survey Bull. 946–B, 1945, pp. 49–71. White, Donald E., and Gonzáles R., Jenaro, San José Antimony Mines near Wadley, State of San Luis Potosí, México: Geol. Survey Bull. 946–E, 1946, pp. 131–135.

CADMIUM

By Thomas P. Wootton

SUMMARY OUTLINE

SUMMARY

Cessation of hostilities brought little relief to cadmium consumers. Distribution of the metal had been dominated by military demand for the first half of the year; but rapid reconversion to peacetime uses, particularly plating and the production of pigments, called for the metal in quantities greater than the production rate. To help meet this demand, the Government stock pile of the metal was reduced 24 percent—from 1,190,179 pounds on December 31, 1944, to 907,425 pounds a year later. Production of primary metal declined 6 percent; and, although output of primary compounds jumped 38 percent over 1944, net decrease in total primary products amounted to nearly 5 percent.

Control by Government agencies—the War Production Board and its successor, the Civilian Production Administration—was maintained until August 20, when General Preference Order M–65 was revoked. Inventories, however, were limited to 45 days' requirements or a minimum working inventory, whichever was smaller. Control was reinstated effective February 1, 1946, by the CPA under Conservation Order M–389, which limited use of the metal by manufacturers to 90 percent of their consumption in 1941. At the same time, inventories were reduced to 30 days' supply by an amendment to table 1 of Priorities Regulation 32.

Office of Price Administration ceiling prices of 90 cents a pound for commercial sticks and 95 cents for patented shapes were unchanged in 1945.

Salient statistics of the cadmium industry in the United States, 1941–45, in pounds

	1941	1942	1943	1944	1945
Production (primary)	7,233,500	7,370,969	8,466,963	8,779,856	8,383,629
Imports (metal)	147,378	53,298	48,891	66,627	28,724
Exports	[1] 171,858	[1] 283,630	[2] 156,844	[2] 548,015	[2] 102,199
Consumption	7,766,000	7,659,000	7,381,000	8,865,000	[3] 3,753,700
Stocks (year end)	2,610,643	2,338,638	3,405,809	3,026,940	1,679,606

[1] Metal, plus cadmium content of compounds.
[2] Metal.
[3] January to June, inclusive.

DOMESTIC PRODUCTION

The entire supply of domestic primary cadmium is recovered concurrently with the treatment of ores of other metals—notably those of zinc and lead—both imported and mined in the United States. As there are no mines operated solely for the cadmium content of their ores and as many reduction plants participating in the recovery of cadmium treat both domestic and foreign materials without determining the cadmium content of either, the origin of the metal produced at United States plants is a matter of conjecture. Thus the data presented as domestic cadmium production in this chapter are not comparable to those given in other chapters for metals like copper, lead, and zinc. Most of the metal is extracted from Cottrell and bag-house dusts, the next important source being the sludges precipitated from zinc solution preliminary to the electrolytic recovery of zinc. Secondary metal is recovered from old bearings and other alloys but constitutes no great part of the total cadmium supply.

In 1945, for the first time in 7 years, domestic output of primary metallic cadmium declined, the decrease being 6 percent. Recovery of secondary metal also dropped, but the output of cadmium contained in primary compounds increased 38 percent. Labor shortage and unrest at zinc-reduction plants were largely responsible for the decrease in primary cadmium output.

Cadmium produced and shipped in the United States, 1941–45, in pounds

	1941	1942	1943	1944	1945
Production:					
Primary:					
Metallic cadmium	6,937,931	7,323,346	8,396,292	8,453,470	7,932,579
Cadmium compounds (Cd content)[1]	295,600	47,623	70,671	326,386	451,050
Total primary production	7,233,531	7,370,969	8,466,963	8,779,856	8,383,629
Secondary (metal and Cd content of compounds)[1 2]	379,500	316,345	162,424	106,850	72,473
Shipments by producers:					
Primary:					
Metallic cadmium	7,044,417	7,233,043	8,326,768	8,551,424	7,938,658
Cadmium compounds (Cd content)[1]	265,700	78,059	137,952	285,203	451,050
Total primary shipments	7,310,117	7,311,102	8,464,720	8,836,627	8,389,708
Secondary (metal and Cd content of compounds)[1 2]	376,500	304,894	187,913	106,850	67,513
Value of primary shipments:					
Metallic cadmium	$5,498,404	$5,740,082	$6,570,546	$6,435,124	$6,106,992
Cadmium compounds	207,246	61,948	108,844	213,902	347,308
Total value	5,705,650	5,802,030	6,679,390	6,649,026	6,454,300

[1] Excludes compounds made from metal.
[2] Bureau of Mines not at liberty to publish figures separately for secondary cadmium compounds.

As in the past, primary metallic cadmium was produced mainly in the Western States, 64 percent coming from four plants in three of those States. The output of six plants in five Central States (including Texas) was 28 percent of the total, and the remaining 8 percent was produced in four plants in two Eastern States. The Midvale, Utah, cadmium plant of the U. S. Smelting, Refining & Mining Co. was idle, as was also the Dumas, Tex., plant of the American

Zinc Co. of Illinois, and the Coffeyville, Kans., plant of the Sherwin-Williams Co. The Bunker Hill & Sullivan Mining & Concentrating Co. built an entirely new plant at Bradley, Idaho, which came into production in June 1945.

Primary compounds—that is, those derived directly from flue dust or from electrolytic zinc-plant residues—are made by five plants, only one of which (American Smelting & Refining Co., Denver) also produces primary metal.

Secondary cadmium metal is recovered by three plants from old bearings, cadmium-bearing alloys, skimmings, drosses, and other sources. Of the total annual output of primary and secondary metal in any one year, less than 2 percent has been recovered from material of secondary origin.

Domestic cadmium-recovery units.—There are 18 plants in the United States equipped to recover primary metallic cadmium.

The American Smelting & Refining Co. produces the metal and sulfide from imported and domestic dust and sludge and makes oxide from some of the metal in its Globe refinery at Denver; in its Corpus Christi plant only the metal, which is electrolytically deposited from zinc-plant solutions, is recovered.

The cadmium-recovery plant of the American Zinc Co. of Illinois, at Dumas, Tex., has been idle for more than a year, and its dust, as well as sponge from the Monsanto, Ill., plant, is treated in the Company's East St. Louis cadmium-recovery unit.

The Anaconda Copper Corp. is the second-largest producer of cadmium in the United States. This company, at its Great Falls, Mont., plant, not only treats cadmium-bearing material from Anaconda properties but also recovers the metal on a toll basis for the United States Government and for other companies, including the Callahan Zinc-Lead Co. and the U. S. Smelting, Refining & Mining Co.

The Bunker Hill & Sullivan Mining & Concentrating Co. completed construction on the cadmium addition to its Bunker Hill lead smelter at Bradley, Idaho, in May 1945 and cast the first refined bars in June. The metal is recovered from fume formerly treated in the nearby electrolytic zinc plant of the Sullivan Mining Co., Silver King, Idaho. The fume is broken up and leached with sulfuric acid, and the cadmium is precipitated from the leaching solution with zinc dust. The resulting sponge is filtered and briquetted, and 600-pound charges are placed in oil-fired retorts with 5 pounds of coke. The refined metal is cast into molds under candle wax to prevent oxidation and discoloration. Finished bars are 4 by 16 inches and three-quarters of an inch thick. They are packed for the market in wooden boxes containing seven bars, or approximately 100 pounds of metal. Detailed descriptions [1] of this newest domestic cadmium plant have been published.

The Eagle-Picher companies have two cadmium-recovery units, one at Galena, Kans., and one at Henryetta, Okla.

The National Zinc Co. recovers metallic cadmium at its zinc smelter at Bartlesville, Okla.

The Neo-Smelting & Refining, Inc., plant at Whitestone, N. Y., is

[1] Mining World (Seattle), How Bunker Hill Recovers Cadmium from Smelter Flue Dust: Vol. 7, No. 12, November 1945, pp. 21–24.
Huttl, John B., Bunker Hill Plant Recovers Metallic Cadmium from Fume: Eng. and Min. Jour., vol. 147, No. 4, April 1946, pp. 82–85.

the only one in the country regularly engaged in the recovery of both primary and secondary cadmium.

At the zinc-redistillation plant of the New Jersey Zinc Co. at Palmerton, Pa., cadmium (and any other impurity) is removed by fractional distillation. The cadmium is subsequently recovered from the resulting zinc-cadmium metal and cadmium dust. About half of the refined cadmium is sold to consumers and the remainder transferred to the Pigment Division, where it is manufactured into luminous paints.

The St. Joseph Lead Co. operates two cadmium-recovery units, one at its lead smelter at Herculaneum, Mo., and one at its electrothermic zinc plant at Josephtown, Pa. The company also acts as agent in distributing metallic cadmium for other producers.

The Sherwin-Williams Co. has a cadmium plant at Coffeyville, Kans., but no cadmium was recovered there in 1945.

Metallic cadmium is obtained by electrolysis at the electrolytic zinc plant of the Sullivan Mining Co. at Silver King, Idaho.

The electrolytic cadmium plant of the U. S. Smelting, Refining & Mining Co. at Midvale, Utah, was not operated in 1945, but some metal was produced for the company on a toll basis by the Anaconda Copper Corp.

At Donora, Pa., the American Steel & Wire Co., a subsidiary of the U. S. Steel Corp., recovers cadmium from purchased residues and dust and from its own residues and sludges.

The New England Chemical Works, Putnam, Conn., has facilities for recovering metallic cadmium from material of primary and secondary origin but has reported no production since July 1943.

The output of miscellaneous cadmium compounds and chemicals increased 8 percent to more than a million pounds of contained cadmium. Although the major portions of these products are made from metal and from other compounds, and from drosses and other secondary materials, appreciable quantities are derived directly from flue dust and other primary materials. In the accompanying table figures on certain compounds are grouped to avoid disclosure of confidential information.

Cadmium compounds produced in the United States, 1943–45, in pounds

Compound	1943		1944		1945	
	Gross weight	Cd content	Gross weight	Cd content	Gross weight	Cd content
Sulfide [1]	671,831	227,045	1,312,263	466,794	1,731,510	637,667
Oxide [2]	511,382	447,143	539,897	471,845	439,415	383,553
Nitrate	------	------	[3] 11,299	[3] 7,453	15,536	10,398
Hydrate	[4] 9,995	[4] 6,129				
Chloride	10,973	5,503	[3] 27,175	[3] 10,582	27,851	12,083
Carbonate	6,383	4,044	6,137	3,990	6,743	4,473
Bromide	1,844	598	[3] 16,627	[3] 7,406	6,170	2,502
Sulfate	4,790	2,354				
Iodide	(4)	(4)	[3] 4,740	[3] 1,737	4,573	1,562
Acetate	1,892	832				
Total production	1,219,090	693,648	[3] 1,918,138	[3] 969,807	2,231,798	1,052,238

[1] Includes cadmium lithopone and cadmium sulfoselenide.
[2] In addition to quantities shown, cadmium oxide consumed in making other compounds shown was produced as follows: 1943, 25,975 pounds (Cd content, 22,833 pounds); 1944, 31,469 pounds (Cd content, 27,662 pounds); comparable break-down for 1945 not available.
[3] Revised.
[4] Iodide included with hydrate to avoid disclosure of confidential figures.

CONSUMPTION AND USES

The accompanying table shows the use pattern of cadmium for 1942–44 and for the first half of 1945. The WPB dropped its monthly canvass of cadmium consumers on June 30, and complete data on consumption for the year therefore are not available. It is believed however, that consumption of the metal for electroplating, for the manufacture of pigments, and possibly for the production of miscellaneous alloys increased sharply in the second half of the year. Military uses, which are included with those listed as other, virtually disappeared.

Consumption of cadmium in the United States, 1942–45 by uses

Use	1942		1943		1944		1945 [1]	
	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total	Pounds	Percent of total
Electroplating	6,661,000	87	6,481,000	88	5,496,000	62	2,559,500	68
Bearings	282,000	4	249,000	3	798,000	9	518,000	14
Solders	201,000	3	285,000	4	266,000	3	214,900	6
Other alloys	98,000	1	198,000	2	89,000	1	72,800	2
Pigments	367,000	4	139,000	2	177,000	2	69,700	2
Chemicals	50,000	1	29,000	1	89,000	1	17,900	(2)
Other [3]					1,950,000	22	300,900	8
	7,659,000	100	7,381,000	100	8,865,000	100	3,753,700	100

[1] January to June, inclusive.
[2] Less than 0.50 percent.
[3] Includes cadmium for unspecified uses.

STOCKS

Total domestic stocks of cadmium metal and compounds, including the Government stock pile of metallic cadmium, decreased 45 percent. Details are given in the accompanying table.

Cadmium stocks at end of year, 1944–45, in pounds

	1944			1945		
	Metallic cadmium	Cadmium compounds (Cd content)	Total cadmium	Metallic cadmium	Cadmium compounds (Cd content)	Total cadmium
Producers	306,896	63,186	370,082	245,769	71,511	317,280
Compound manufacturers	11,558	63,267	74,825	17,085	31,070	48,155
Distributors [1]	358,605	62,766	421,371	380,184	26,562	406,746
Consumers [2]	924,483	46,000	970,483	(3)	(3)	(3)
Government	1,190,179		1,190,179	907,425		907,425
Total stocks	2,791,721	235,219	3,026,940	1,550,463	129,143	1,679,606

[1] Comprises principally 6 largest dealers.
[2] Partly estimated. Includes some material in process. Excludes stocks of compounds held by pigment and chemical consumers.
[3] Comparable data for 1945 not available.

PRICES

OPA ceiling prices of 90 cents a pound for metallic cadmium sticks and 95 cents a pound for patented shapes prevailed throughout the year. Average value of domestic metal, as reported to the Bureau of Mines by primary producers, was 77 cents a pound in 1945 compared with 75 cents in 1944, 79 cents in 1943 and 1942, and 78 cents in 1941. According to E&MJ Metal and Mineral Markets, producers' quotations remained 90 cents a pound.

Prices for cadmium compounds, as quoted by Oil, Paint and Drug Reporter, were $1.65 to $1.91 a pound for the bromide, $0.85 to $1.00 for red lithopone, $0.55 to $0.65 for yellow lithopone, and $1.10 for the sulfide, unchanged from the previous year.

FOREIGN TRADE [2]

In 1945 total imports for consumption of metallic cadmium and of cadmium contained in flue dust increased 27 percent in weight from 1,755,949 to 2,221,409 pounds and 13 percent in value from $898,599 to $1,018,105. Exports, data for which are presented in a table this year for the first time, decreased nearly 60 percent in total value.

Imports.—The sole source of imported flue dust in 1945 was Mexico, as has been the case since 1942. Imports from both Peru and Belgian Congo continued, but at a decrease of more than half. Although the accompanying table of imports shows only metal and dust, a very considerable additional quantity of cadmium actually comes into the United States in zinc ores and concentrates produced in several foreign countries, including Canada, Labrador, Newfoundland, Mexico, and Argentina. Much of this cadmium is recovered in the reduction of these imported materials.

Cadmium metal and flue dust imported for consumption in the United States, 1943–45, by countries

Country	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Metallic cadmium						
Belgian Congo	40,355	$33,325	53,082	$50,699	25,798	$22,997
Canada	------	------	------	------	672	793
Italy	------	------	8,656	7,790	------	------
Peru	8,536	7,839	4,889	4,495	2,254	2,029
	48,891	41,164	66,627	62,984	28,724	25,819
Flue dust (Cd content)						
Mexico	1,643,404	814,920	1,689,322	835,615	2,192,685	992,286
	1,692,295	856,084	1,755,949	898,599	2,221,409	1,018,105

Exports.—The total value of cadmium exported in 1945 was less than half that of the previous year, the most notable change being in metallic cadmium. This was brought about by cessation or curtailment of lend-lease shipments.

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cadmium exported from the United States, 1943–45, gross weight, by kinds

Kind	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Dross, flue dust, residues, and scrap	520	$1,198	2,686,360	$217,640	2,333,720	$197,927
Metal	156,844	148,462	548,015	515,447	102,199	100,493
Alloys	72,535	70,029	450	427	3	8
Salts and compounds	19,307	18,395	23,488	25,107	10,895	10,781
	----------	238,084	----------	758,621	----------	309,209

WORLD PRODUCTION

Available information on world production of metallic cadmium and United States production of the metal and of primary compounds during recent years is presented in the following table. Very few production data for the war period have been obtained from the defeated and liberated countries as yet, and world totals for the years since 1940 cannot be given.

World production of cadmium, 1938–45, by countries, in kilograms

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Australia (Tasmania)	199,326	175,150	175,232	194,975	165,821	160,100	253,972	[1] 258,077
Belgian Congo	----------	----------	----------	3,086	27,344	23,094	21,544	[2] 17,000
Belgium	182,000	[3] 530,800	(4)	(4)	(4)	(4)	(4)	(4)
Canada	317,122	426,234	411,917	567,573	521,158	356,804	239,032	288,941
France	116,000	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Germany	432,000	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Italy	181,530	146,417	214,871	184,016	(4)	(4)	(4)	(4)
Japan	[2] 30,000	(4)	(4)	(4)	(4)	(4)	(4)	(4)
Mexico [5]	762,398	816,584	815,734	906,577	854,264	801,992	701,010	1,052,766
Norway	207,667	138,000	(4)	(4)	13,482	11,200	(4)	(4)
Peru	----------	----------	----------	----------	2,131	3,653	2,174	1,250
Poland	182,591	(4)	(4)	(4)	(4)	(4)	(4)	49,150
South-West Africa [5]	259,133	82,155	39,634	[6] 179,597	(4)	(4)	(4)	(4)
U. S. S. R.	[2] 50,000	(4)	(4)	(4)	(4)	(4)	(4)	(4)
United Kingdom	124,898	(4)	(4)	(4)	(4)	(4)	(4)	(4)
United States:								
Metallic cadmium	1,849,722	2,001,026	2,791,484	3,146,976	3,321,797	3,808,474	3,834,409	3,598,139
Cadmium compounds (Cd content)	98,200	171,900	95,000	134,000	21,600	32,100	148,045	204,592
	3,971,100	4,300,000	4,800,000	(4)	(4)	(4)	(4)	(4)

[1] Year ended June 30 of year stated.
[2] Estimate.
[3] Exports.
[4] Data not available; in 1939 and 1940, estimate included in total.
[5] Cadmium content of flue dust exported for treatment elsewhere; represents in part shipments from stocks on hand. To avoid duplication of figures, the data are not included in the total.
[6] Figures cover January to June, inclusive.

REVIEW BY COUNTRIES

Australia (Tasmania).—The Electrolytic Zinc Co. of Australasia, Ltd., operating mines and a milling plant at Rosebery, on the west coast, and a smelter at Risdon, near Hobart, Tasmania, increased its output of cadmium 25 percent to 254 long tons of metal. The raw material consists of zinc concentrates, calcines, and flue dusts. About one-third of this comes from company operations on the island of Tasmania and the remainder from the three largest mines in the

Broken Hill district in New South Wales on the Australian mainland.

Belgian Congo.—Production of cadmium from zinc concentrates, roasted by "Sogechim," a subsidiary of Union Minière du Haut-Katanga, for the manufacture of sulfuric acid needed locally, decreased from 22 metric tons to an estimated 17 metric tons.

Canada.—Canadian output of refined metallic cadmium is derived from the zinc and lead ores of British Columbia and the zinc-copper ores of Saskatchewan and Manitoba. The Consolidated Mining & Smelting Co. of Canada, Ltd., at Tadanac (Trail), British Columbia, and the Hudson Bay Mining & Smelting Co., Ltd., at Flin Flon, Manitoba, produced approximately 80 and 20 percent, respectively, of the total Canadian output. A considerable quantity of cadmium of Canadian origin also is extracted at plants in the United States from imported zinc ores and concentrates.

Japan.—No official production figures have been received from the Japanese in many years. However, records obtained by United States armed forces after the occupation show that the Miike zinc-reduction works at Omuta on the island of Kyushu produced 9,000 kilos of cadmium in the first 7 months of 1945.

Mexico.—The 1945 exports of cadmium contained in flue dusts recovered from ores of Mexican origin were the highest on record. This material is recovered at the reduction works of the American Smelting & Refining Co. and the American Metal Co., Ltd., and all of it is exported for treatment—mostly to the United States. In addition to the cadmium contained in flue dust, an undeclared quantity of the metal is exported in zinc ores and concentrates. It is probable that, on a mine-output basis, Mexico is the world's largest producer of cadmium.

Peru.—Beginning in 1942 the Cerro de Pasco Copper Corp. added cadmium to its long list of metals recovered from Peruvian ores at the Oroya metallurgical plant. At present the output is 2 to 3 metric tons a year, all from operations of the electrolytic zinc pilot plant. An unrecorded quantity is exported to the United States with zinc concentrates from company concentrators.

PLATINUM AND ALLIED METALS

By Hubert W. Davis and Gertrude N. Greenspoon

SUMMARY OUTLINE

SUMMARY

An outstanding feature of the platinum industry in 1945 was the revocation by War Production Board on August 20 of Order M-162, which, since October 31, 1942, had prohibited use of platinum and platinum alloys in new jewelry. This was followed by a demand for platinum by the jewelry trade which quickly assumed boom proportions; as a result, sufficient metal was not available. Restrictions on use of rhodium and osmium were also removed on August 20. Limitations on use of iridium and palladium had been removed previously. During the war, ruthenium was the only metal of the platinum group not subjected to usage control at any time. Maximum prices, established by Office of Price Administration on February 1, 1943, remained in effect for all platinum metals. However, despite a ceiling price of $165 an ounce for iridium, it was quoted at $120 to $90 an ounce.

Salient statistics of platinum and allied metals in the United States, 1944–45, in troy ounces

	1944	1945		1944	1945
Production:			Stocks in hands of refiners, importers, and dealers, Dec. 31:		
Crude platinum from placers	33,625	26,551	Platinum	159,173	138,839
New metals:			Palladium	123,448	119,757
Platinum	132,452	162,032	Other	39,866	43,376
Palladium	10,966	28,649		322,487	301,972
Other	9,627	13,825	Imports for consumption:		
	153,045	204,506	Unrefined materials	137,192	172,029
Secondary metals:			Refined metals	219,020	211,269
Platinum	[1] 85,942	58,942		356,212	383,298
Palladium	[1] 29,684	32,968	Exports:		
Other	[1] 3,770	4,212	Refined metals and alloys, including scrap	6,257	18,732
	[1] 119,396	96,122	Manufactures (except jewelry)	2,387	5,906

[1] Revised figures.

Although slightly more platinum was refined than in 1944, it was insufficient for domestic requirements in 1945, which were 22 percent greater than in the previous year. The refined-metal deficiency was met by release of Government stocks, by imports, and by withdrawals from refiners' and dealers' inventories. The gain in sales of platinum in 1945 over 1944 was due chiefly to much larger requirements by the chemical industry and to the boom demand by the jewelry trade; sales of platinum in 1945 were the second highest of record.

Refining of palladium was 52 percent greater than in 1944, but it again was insufficient for requirements, which established a new record. The deficit was met largely by imports of refined metal but partly by withdrawals from refiners' and dealers' inventories. With removal of the restriction on the use of platinum in jewelry, there was a decided swing from palladium to platinum for fine jewelry; nevertheless, the jewelry trade continued to absorb substantial quantities of palladium. Both refining and sales of the other platinum metals—iridium, osmium, rhodium, and ruthenium—were comparatively small in 1945; however, both refining and sales were greater than in 1944. Nevertheless, sales of each metal except rhodium substantially exceeded the quantity refined. The deficits in iridium, osmium, and ruthenium were met by imports of refined metals.

The importance of the United States as a refining center for platinum metals during the 7 years 1939–45 is reflected in its record of refining. During this period, 1,334,537 ounces of platinum metals were recovered from the refining of virgin materials; this quantity is 20 percent more than was refined during the previous 25 years 1914–38—1,112,509 ounces.

Imports of platinum metals into the United States established a new high in 1945; they were 6 percent greater than in the previous record year 1943.

The outlook for platinum has been discussed and the contribution made by the platinum metals in the war program has been reviewed by the South African Mining and Engineering Journal.[1]

* * * The war created an intensive demand for platinum, far beyond the capacity of the industry to meet in the early stages. By dint of tremendous efforts, however, the demand was met by about 1943, but so many new uses have been found for the metal that there is little doubt that world output will have to be maintained at levels quite considerably higher than those obtaining before the war. Manufacturing jewelers have been unable to secure anything like the amount of platinum they require, and consequently palladium has been used to a large extent as a substitute. The white color of palladium is used with advantage in setting gems and in two-color combinations with gold. South African jewelers have indicated that they are extremely short of platinum and are capable of using very much more than they can obtain.

The platinum metals contributed handsomely to winning the war. Use was made of their peculiar characteristics in many ways, and the industrial uses of platinum have been greatly expanded by research conducted during the war years. Large quantities were used in winning the war in the air, for magneto contacts, and spark plug electrodes were made from platinum and absorbed huge quantities of the metal. Radar required large quantities of platinum, for it was found that the metal was superior to all the others tried. One of the most notable advancements in the field of electronics generally, into which radar can be said to fall, was the development of platinum and platinum-clad grids in high frequency transmission valves. In addition, the new bomb sights developed by the United States and Britain used platinum in their construction, and the computing devices

[1] South African Mining and Engineering Journal, The Outlook for Platinum: Vol. 57, pt. I, Apr. 6, 1946, p. 127.

developed in the high-flying superfortresses, by which the defensive machine guns could be fired by remote control, needed large quantities of platinum.

The uses of platinum in the chemical industries are many. Platinum alloys are used as catalysts in the manufacture of nitric acid, one of the principal raw materials in the making of explosives. Rayon and glass fibre played an important part in the war effort, and platinum alloy spinnerets and bushings were extensively used in the production of both these products. Insoluble platinum anodes were used for the production of the perchlorates, peroxides and other chemicals obtained through anodic oxidation and were used in the production of war equipment which made use of the electrodeposition of nickel, rhodium and other metals. Measuring and recording devices were developed which made use of the corrosion and heat resisting properties of platinum, as well as of their mechanical and electrical properties.

Not the least important application of the metal has been the adaption to chemical and other appliances and equipment in increasing quantities. It has been found that platinum gives better service in many directions, with less maintenance, while the use of the metal in many chemical processes has resulted in a better product at lower cost.

* * * Platinum is no longer a metal which finds use only in luxury trades; it has taken off its white collar and put on overalls. Progress was being made in this direction before the outbreak of war, but the past six years have greatly expanded the number of industrial uses to which platinum can be put. * * *

Figure 1 shows graphically the trend in world production of platinum metals from 1914 to 1944.

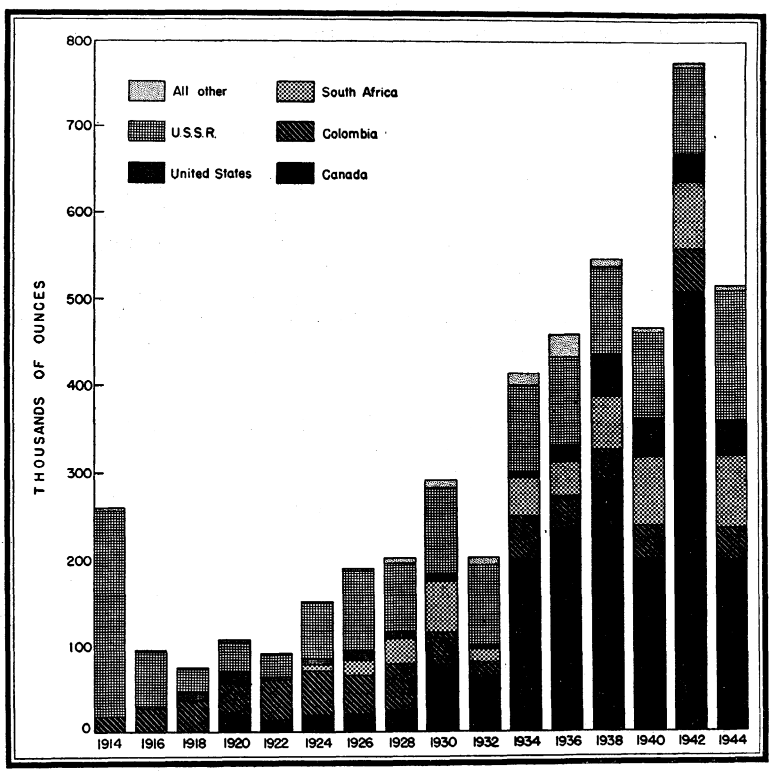

FIGURE 1.—Trend in world production of platinum metals, 1914–44.

CRUDE PLATINUM

Production.—Mine returns for 1945 show a production of 26,505 ounces of crude platinum in Alaska, 43 ounces in California, and 3 ounces in Oregon—a total of 26,551 ounces; comparable figures for 1944 are 33,616 ounces of crude platinum in Alaska and 9 ounces in Montana—a total of 33,625 ounces. Production in Alaska came from placer deposits in the Goodnews Bay district of southwestern Alaska. The output in California was a byproduct of gold placers in Trinity and Yuba Counties. Production in Oregon came from Josephine County.

Many gold and copper ores in the United States contain small quantities of platinum metals. In 1945, 4,495 ounces of platinum metals were recovered as byproducts of refining gold and copper ores compared with 6,924 ounces in 1944.

Purchases.—Buyers in the United States reported purchases of domestic crude platinum from the following sources in 1945: Alaska, 27,045 ounces and California, 25 ounces—a total of 27,070 ounces (33,841 ounces in 1944). Domestic buyers also reported purchases of 29,571 ounces (29,700 ounces in 1944) of foreign crude platinum from Colombia in 1945.

Prices.—Buyers reported purchases at $28.07 to $34.90 an ounce for domestic and foreign crude platinum in 1945. This price range resulted chiefly from variations in iridium content of crudes rather than from market fluctuations for refined platinum metals.

REFINED PLATINUM METALS

New metals recovered.—Reports from refiners of crude platinum, gold bullion, nickel, and copper indicate that 204,506 ounces of platinum metals were recovered in the United States from such sources in 1945—an increase of 34 percent over 1944. Of the new metals recovered in 1945, 84 percent was chiefly from concentrates from Canada and crude from Colombia, 14 percent from domestic crude (chiefly from Alaska), and 2 percent a byproduct of domestic gold and copper ores.

New platinum metals recovered by refiners in the United States in 1945, by sources, in troy ounces

	Platinum	Palladium	Iridium	Osmium	Rhodium	Ruthenium	Total
Domestic from—							
Crude platinum	22,923	126	4,453	845	632	118	29,097
Gold and copper refining	1,068	3,396	8		20	3	4,495
	23,991	3,522	4,461	845	652	121	33,592
Foreign from—							
Crude platinum / Nickel and copper refining	138,041	25,127	1,322		4,079	2,345	170,914
Total recovery	162,032	28,649	5,783	845	4,731	2,466	204,506

New platinum metals recovered by refiners in the United States, 1941–45, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1941	98,376	49,812	1,392	3,043	152,623
1942	244,226	140,262	5,102	10,737	400,327
1943	234,320	82,441	5,286	13,209	335,256
1944	132,452	10,966	4,406	5,221	153,045
1945	162,032	28,649	5,783	8,042	204,506

Secondary metals recovered.—In 1945, 96,122 ounces of secondary platinum metals were recovered from the refining of scrap metal, sweeps, and other waste products of manufacture that contain platinum metals—a 19-percent decrease from 1944.

Substantial quantities of worn-out catalysts, spinnerets, laboratory ware, and other products are returned by consumers to refiners for refining. The refined platinum metals recovered from these products (or their equivalent in refined metals) are returned to the consumers. The platinum metals so recovered are not included in the statistics of secondary metals.

Secondary platinum metals recovered in the United States, 1941–45, in troy ounces

Year	Platinum	Palladium	Iridium	Others	Total
1941	37,522	12,630	659	758	51,569
1942	56,150	16,416	1,552	2,493	76,611
1943	68,613	23,616	2,771	6,581	101,581
1944 [1]	85,942	29,684	965	2,805	119,396
1945	58,942	32,968	812	3,400	96,122

[1] Revised figures.

Prices.—Maximum prices for the six platinum metals, fixed by the Office of Price Administration on February 1, 1943, remained in effect in 1945. The maximum prices per troy ounce for refined metals of a commercial purity of at least 99.5 percent were as follows: Platinum, $35; palladium, $24; iridium, $165; osmium, $50; rhodium, $125; and ruthenium, $35.

Except for iridium, prices for the platinum-group metals remained stable in 1945. However, iridium was quoted at $120 to August 9, when it was reduced to $100; on September 13 it was lowered to $100–$90, where it remained for the rest of 1945.

Properties and uses.—Much information on the platinum metals and their alloys, particularly their physical and mechanical properties and their many and diverse uses, is given in the comprehensive book, The Platinum Metals and Their Alloys, published in 1941 by the International Nickel Co., Inc., New York, N. Y. A tabulation of uses of the platinum metals is given on page 801 of the Platinum and Allied Metals chapter in Minerals Yearbook, 1943.

Consumption.—As pure metals, combined, clad, or alloyed with other metals, the platinum metals are employed in the electrical and chemical industries, in dentistry and jewelry, and for numerous miscellaneous purposes. Sales to consumers in the United States established a new high in 1945; they were 550,045 ounces, a gain of 22 percent over 1944 and 8 percent greater than the previous record year 1943.

The most widely used metal of the group is platinum, which constituted 336,851 ounces (61 percent) of the total platinum metals sold to consumers in the United States in 1945. By taking 34.4 percent of the total platinum sold in 1945, the chemical industry was the chief buyer, displacing the electrical industry, which ranked first in 1943 and 1944. Sales of platinum to the chemical industry were 90 percent greater than in 1944. The largest outlets for platinum in the chemical industry were for chemical manufacturing equipment, catalysts, laboratory ware, and spinnerets. The electrical industry was a close second as a buyer of platinum in 1945, but its purchases were 40 percent less than in 1944; nevertheless, it bought 107,260 ounces (31.8 percent) of the total sold. The largest outlets for platinum in the electrical industry were for spark plugs, magneto and other contacts, and electronic tubes. Sales of platinum for dental and medical uses declined 11 percent from 1944 but comprised 30,871 ounces (9.2 percent) of the total sold. Because of the ban on the sale and use of platinum in the manufacture of jewelry, except for repair work, only 424 ounces were so sold in 1944. On August 20 the WPB revoked Order M-162 which, since October 31, 1942, had prohibited the sale and use of platinum and platinum alloys in new jewelry. Removal of this restriction was followed by a demand for platinum by the jewelry trade which quickly assumed boom proportions. Accordingly, the jewelry industry bought 81,305 ounces (24.1 percent) of the total platinum sold in 1945.

Next to platinum, palladium is the most extensively used metal of the group; it constituted 185,232 ounces (34 percent) of the total platinum metals sold to domestic consumers in 1945. Sales of palladium established a new high in 1945. The electrical industry displaced the jewelry industry as the chief outlet for palladium in 1945 by taking 69,300 ounces (37.4 percent) of the total palladium sold. Sales of palladium to the electrical industry established a new record in 1945 and were 64 percent greater than in 1944. Sales of palladium to the jewelry trade comprised 56,578 ounces (30.5 percent) of the total palladium sold in 1945; they were virtually the same as in 1944. With removal of the restriction on the use of platinum in jewelry, there was a decided swing from palladium to platinum for fine jewelry, The dental trade continued to be the third largest outlet for palladium, taking 42,259 ounces (22.8 percent) of the total sold in 1945. Sales of palladium to the chemical industry were 7 percent less than in 1944 and were only 8,988 ounces (4.9 percent) of the total sold in 1945. Appreciable quantities of palladium were sold to the pen and pencil trade for nibs and other parts in 1945.

Sales of the other platinum metals—iridium, osmium, rhodium, and ruthenium—were comparatively small; they made up 5 percent (27,962 ounces) of the total for the group in 1945. Iridium and ruthenium were the metals of this group most extensively used, followed in order by rhodium and osmium. Sales of iridium and rhodium were each about 50 percent greater than in 1944, but those of osmium and ruthenium were only 15 and 2 percent, respectively, more.

The following table shows sales of platinum metals by refiners, importers, dealers, and Office of Metals Reserve to consumers in the United States in 1945.

Platinum metals sold to consuming industries in the United States in 1945, in troy ounces

Industry	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
Chemical	115,816	8,988	6,182	130,986
Electrical	107,260	69,300	5,572	182,132
Dental and medical	30,871	42,259	900	74,030
Jewelry and decorative	81,305	56,578	10,026	147,909
Miscellaneous and undistributed	1,599	8,107	5,282	14,988
	336,851	185,232	27,962	550,045

Stocks.—Stocks of platinum metals in all forms in the hands of refiners, importers, and dealers totaled 301,972 ounces on December 31, 1945, compared with 322,487 ounces at the close of 1944. In addition, the Office of Metals Reserve held 63,252 ounces of refined metals and 15,251 ounces of crude platinum on December 31, 1945.

Stocks of platinum metals held by refiners, importers, and dealers in the United States, Dec. 31, 1941–45, in troy ounces

Year	Platinum	Palladium	Iridium, osmium, rhodium, and ruthenium	Total
1941	150,887	138,014	33,942	322,843
1942	160,724	107,383	35,280	303,387
1943	176,560	104,372	42,081	323,013
1944	159,173	123,448	39,866	322,487
1945	138,839	119,757	43,376	301,972

FOREIGN TRADE [2]

Imports.—Imports of platinum metals into the United States established a new high in 1945; they were 8 percent more than in 1944 and 6 percent greater than in the previous record year 1943. The principal sources of imported platinum metals in 1945 were Canada (266,534 ounces), U. S. S. R. (77,741 ounces). Colombia (31,786 ounces), and United Kingdom (7,149 ounces). Imports of unrefined materials (172,029 ounces) were 25 percent more than in 1944, but imports of refined metals (211,269 ounces) were 4 percent less. Imports of refined platinum, iridium, rhodium, and ruthenium were 4, 102, 689, and 40 percent, respectively, greater than in 1944, but imports of palladium and osmium were 14 and 31 percent, respectively, less.

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Platinum metals (unmanufactured) imported for consumption in the United States 1944–45

Material	1944		1945	
	Troy ounces	Value	Troy ounces	Value
Unrefined materials: [1]				
Ores and concentrates of platinum metals	101,747	$2,993,639	138,089	$3,955,645
Grains and nuggets (including crude, dust, and residues)	35,345	1,014,169	31,875	1,041,684
Sponge and scrap	65	1,690	2,008	63,903
Osmiridium	35	2,593	57	4,261
	137,192	4,012,091	172,029	5,065,493
Refined metals:				
Platinum	70,150	2,631,546	72,849	2,688,613
Palladium	137,496	3,116,904	118,270	2,597,815
Iridium	3,075	597,159	6,197	504,666
Osmium	1,345	72,669	925	43,669
Rhodium	504	47,044	3,975	452,873
Ruthenium	6,450	197,890	9,053	296,804
	219,020	6,663,212	211,269	6,584,440
	356,212	10,675,303	383,298	11,649,933

[1] The concentrates and crude imported from Canada contain platinum, palladium, iridium, rhodium, and ruthenium, and the crude sponge imported from Canada contains platinum and palladium. Although the U. S. Department of Commerce records "platinum content" for these entries, the Bureau of Mines has determined from the importers of these materials that most of the entries reflect the platinum metals content. The Bureau of Mines has also determined from the largest importer of crude platinum from Colombia that the entries for his material, recorded as "platinum content" by the U. S. Department of Commerce, represent the gross weight of the material.

Platinum metals (unmanufactured) imported for consumption in the United States, 1944–45, by countries, in troy ounces

Country	Unrefined materials [1]				Refined metals					Total
	Ores and concentrates of platinum metals	Grains and nuggets (including crude, dust, and residues)	Sponge and scrap	Osmiridium	Platinum	Palladium	Iridium	Osmium	Rhodium and ruthenium	
1944										
Canada	101,747	29	52	14	130	118,532	(2)	-------	2,504	223,008
Colombia	-------	35,316	4	-------	-------	-------	-------	-------	-------	35,320
U. S. S. R.	-------	-------	-------	-------	70,020	3,212	2,090	-------	-------	75,322
United Kingdom	-------	-------	-------	21	-------	15,752	985	1,345	4,450	22,553
Other countries	-------	-------	9	-------	-------	-------	-------	-------	-------	9
	101,747	35,345	65	35	70,150	137,496	3,075	1,345	6,954	356,212
1945										
Australia	-------	-------	-------	29	-------	-------	45	-------	-------	74
Canada	138,089	89	1,997	-------	6,098	107,551	3,932	-------	8,778	266,534
Colombia	-------	31,786	-------	-------	-------	-------	-------	-------	-------	31,786
U. S. S. R.	-------	-------	-------	-------	66,748	9,966	1,027	-------	-------	77,741
United Kingdom	-------	-------	-------	28	-------	753	1,193	925	4,250	7,149
Other countries	-------	-------	11	-------	3	-------	-------	-------	-------	14
	138,089	31,875	2,008	57	72,849	118,270	6,197	925	13,028	383,298

[1] See footnote 1 of preceding table.
[2] Less than 1 ounce.

Platinum metals imported for consumption in the United States, 1941–45 [1]

Year	Troy ounces	Value	Year	Troy ounces	Value
1941	309,995	$7,143,612	1944	356,212	$10,675,303
1942	315,002	11,306,565	1945	383,298	11,649,933
1943	362,251	10,936,243			

[1] See footnote 1 of preceding table.

Exports.—Exports of refined platinum (including scrap) increased to 7,781 ounces in 1945 (1,243 ounces in 1944), and those of the other platinum-group metals (including scrap) advanced to 10,951 ounces (5,014 ounces in 1944). The chief foreign markets for platinum were Brazil (3,909 ounces), United Kingdom (960 ounces), and Australia (523 ounces) and for the other platinum-group metals, Canada (8,996 ounces).

Platinum and allied metals exported from the United States, 1941–45

Year	Ore and concentrates		Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1941	244	$11,713	[1] 15,405	[1] $607,333	(1)	(1)	3,204	$160,674
1942	159	6,581	3,354	126,007	99,107	$2,301,953	1,246	61,088
1943	84	3,642	860	43,961	521	28,264	1,802	70,226
1944			1,243	52,014	5,014	388,930	2,387	99,356
1945			7,781	288,953	10,951	802,843	5,906	160,470

[1] Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium included with platinum; not separately classified before 1942.

Platinum and allied metals exported from the United States, 1944–45, by countries

Country	Platinum (bars, ingots, sheets, wire, sponge, and other forms, including scrap)		Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys, including scrap)		Manufactures of, except jewelry	
	Troy ounces	Value	Troy ounces	Value	Troy ounces	Value
1944						
Argentina	30	$1,080	197	$7,156	3	$280
Brazil	509	20,653	740	22,083	190	11,185
Canada	468	21,903	3,460	343,000	1,736	69,647
Chile	81	3,533	1	42	10	976
China	25	888			117	2,732
Colombia	3	120	141	3,763	2	332
Cuba	22	585	111	2,983	5	381
Mexico	2	73	170	4,766	55	2,257
Uruguay	16	628	160	4,136	(1)	23
Venezuela	38	1,350	25	619	28	646
Other countries	49	1,201	9	382	241	10,897
	1,243	52,014	5,014	388,930	2,387	99,356
1945						
Argentina			8	588	8	463
Australia	523	20,440				
Brazil	3,909	116,083	509	13,051	185	7,093
Canada	488	13,705	8,996	745,524	2,555	32,129
Chile	172	9,887	16	384	24	1,295
China	2	26	16	417	25	473
Colombia	1	59	160	3,989	53	1,265
Cuba	385	13,709	165	4,389	54	2,053
Czechoslovakia	192	1,686			131	2,074
Mexico	271	10,300	453	12,818	163	7,338
Netherlands	33	288			155	778
Poland	57	3,987			331	2,123
Switzerland	1	60	225	11,189	1	33
U. S. S. R.	48	9,284	48	326		
United Kingdom	960	59,505			1,404	90,689
Uruguay	101	3,856	204	5,510		
Venezuela	49	1,855	51	1,196	2	655
Yugoslavia	139	6,478			454	3,321
Other countries	450	17,745	100	3,462	361	8,688
	7,781	288,953	10,951	802,843	5,906	160,470

(1) Less than 1 ounce.

WORLD PRODUCTION

The following table shows world production of platinum-group metals, by countries, from 1938 to 1945, insofar as statistics are available.

World production of platinum and allied metals, 1938–45, in troy ounces

[Compiled by B. B. Waldbauer]

Country and product	1938	1939	1940	1941	1942	1943	1944	1945
Australia:								
New South Wales: Placer platinum	8	7	12	23	2	3	2	(1)
Tasmania: Placer osmiridium	191	283	465	207	142	90	107	109
Belgian Congo: From refineries:								
Palladium	1,575	3,312	(1)	(1)	(1)	(1)	(1)	(1)
Platinum	225	868	(1)	(1)	(1)	(1)	(1)	(1)
Canada:								
Placer platinum	16	25	24	60	30			
From refineries: [2]						219,713	157,523	162,000
Platinum	161,310	148,877	108,464	124,257	285,198			
Other platinum metals	130,893	135,402	91,522	97,432	222,573	126,004	42,929	155,600
Colombia: Placer platinum (exports)	34,549	39,070	35,859	37,349	49,163	39,961	36,136	35,129
Ethiopia: Placer platinum	3,858	6,000	6,000	1,000	1,000	1,000	(1)	(1)
Italy: From refineries: Platinum	1,029	1,608	965	(1)	(1)	(1)	(1)	(1)
Japan: Placer platinum	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Netherlands Indies (probably placer platinum)	21	28	34	(1)	(1)	(1)	(1)	(1)
New Zealand: Placer platinum	1	13	--------	35	21	5	21	(1)
Panama: Placer platinum	--------	--------	--------	(1)	(1)	(1)	(1)	(1)
Papua: [3]								
Placer platinum	41	2	(1)	5	(1)	(1)	(1)	(1)
Placer osmiridium	4	4	(1)	(1)	(1)	(1)	(1)	(1)
Sierra Leone: Placer platinum	180	83	135	21	(1)	(1)	(1)	(1)
Union of South Africa:								
Platinum (content of platinum metals) [4]	18,256	18,068	20,140	16,580	20,065	18,236	19,409	[5] 14,343
Concentrates (content of platinum metals) [4]	35,124	41,243	51,835	69,150	53,190	40,654	57,024	[5] 38,833
Osmiridium [6]	5,354	7,031	(1)	(1)	(1)	(1)	6,896	(1)
U. S. S. R.: Placer platinum (estimate)	100,000	100,000	100,000	100,000	100,000	125,000	150,000	150,000
United States:								
Placer platinum	40,932	32,460	33,800	26,221	23,213	27,162	33,625	26,551
Ore (content of platinum metals)	90	66	--------	15	26	--------	--------	--------
From refineries: [7]								
Platinum	3,761	5,270	4,470	1,805	4,333	5,205	3,286	1,068
Other platinum metals	3,486	3,364	3,304	4,689	5,472	5,185	3,638	3,427
Total (estimate)	541,000	543,000	465,000	483,000	773,000	619,000	512,000	(1)

[1] Data not available.
[2] Recovered from nickel-copper mattes.
[3] Year ended June 30 of year stated.
[4] Produced from platinum ores.
[5] January to September, inclusive.
[6] Produced from treatment of gold ores on the Rand.
[7] New platinum metals recovered in gold and copper refining of domestic materials.

Canada.—According to the Dominion Bureau of Statistics, production of platinum metals from the nickel-copper ores of the Sudbury district, plus a very small quantity from placers in British Columbia, was 162,000 ounces of platinum and 155,600 ounces of other platinum-group metals in 1945, compared with 157,523 ounces of platinum and 42,929 ounces of other platinum-group metals in 1944. Production of platinum metals in 1945 was the second largest of record but 37 percent less than in the record year 1942. The figures on production represent the metals refined from Canadian concentrates at Acton, England, plus the platinum-metals content of concentrates sold, rather than the metals contained in the concentrates actually recovered.

The contribution made by Canada in supplying platinum metals during the 7 years 1939–45 is noteworthy. During this period the nickel-copper ores of the Sudbury district were the source of 1,206,032 ounces of platinum and 871,462 ounces of other platinum-group metals; these quantities were 38 and 15 percent, respectively, greater than supplied during the previous 19 years 1920–38—871,394 and 757,535 ounces, respectively.

Sales of platinum metals by the International Nickel Co. of Canada, Ltd., were 381,741 ounces in 1945—a new peak—compared with 303,394 and 376,604 ounces, respectively, in 1944 and 1943.

Colombia.—The South American Gold & Platinum Co. produced 20,346 ounces of crude platinum metals in 1945 (22,615 in 1944) and 52,464 ounces of crude gold (56,097 in 1944). Production of crude platinum by other operators was 14,411 ounces in 1945.

Union of South Africa.—The Union of South Africa is the third largest producer of platinum metals in the world and ranks first in production of osmiridium. Output of osmiridium, which is recovered from Rand gold ores, was first recorded in 1921 (510 ounces); it increased to 5,764 ounces in 1924 and thereafter has ranged from 5,000 to 7,000 ounces annually.

In 1926, the initial production (10,545 ounces) of platinum metals was made from the platinum ores in the Transvaal, and by 1930 output had reached 55,342 ounces. As a result of a phenomenal drop in platinum price, the general industrial depression, and the relatively high costs of reducing these complex ores, operations were suspended from April 1932 to July 1933; consequently, production declined to 9.246 and 2,386 ounces, respectively, in 1932 and 1933. Meanwhile, the various companies had ceased operations until the only survivor was the Rustenburg Platinum Mines, Ltd. This company resumed production in August 1933, and output averaged about 34,000 ounces annually during the 3 years 1934–36. Thereafter, because of the approaching exhaustion of the oxidized ore, the company plant was enlarged and altered to treat sulfide ore. As a consequence of this change and the increased demand resulting from World War II, output of platinum metals expanded markedly. The total production of platinum metals in the Waterberg, Lydenburg, Potgietersrust, and Rustenburg districts during the 20 years 1926–45 was about 889,700 ounces, of which about 497,000 ounces (56 percent) were produced during the 7 years 1939–45. Since 1931 the entire output has come from the Rustenburg district.

TITANIUM

By Allan F. Matthews and R. Louise Bryson

SUMMARY OUTLINE

GENERAL STATEMENT

Domestic output of titanium concentrates exceeded 300,000 short tons in 1945, placing the United States as the world's foremost producer. Domestic mines yielded 11 percent more ilmenite than in 1944, but imports, largely from India, had to be drawn on for 19 percent of the consumption and for building up stocks in anticipation of a 20-percent expansion in titanium-pigment-manufacturing capacity. Rutile consumption declined one-third as a result of cut-backs in demand for welding rods for ship and tank fabrication and thereby enabled a 4-percent increase in domestic output to supply about half of the demand. The remainder was imported almost exclusively from Australia; Brazil has become only a negligible source of rutile.

Sustaining a complaint by the United States Department of Justice against the National Lead Co., its subsidiary, the Titan Co., and E. I. duPont de Nemours & Co., Inc., Judge Simon H. Rifkind ruled July 11, 1945, that the companies participated in a world monopoly controlling the production and sale of titanium pigments in violation of the Sherman Antitrust Act. It was expected the court would be asked to direct the defendants to grant royalty-free licenses under all their titanium patents and, if necessary, to divest themselves of certain assets to independent competing companies.[1]

DOMESTIC PRODUCTION

Production of ilmenite in 1945 rose 11 percent above that of 1944 and output of rutile increased 4 percent, both achieving all-time highs. Ilmenite concentrate shipments in 1945 ranged from 44 to 59 percent TiO_2 and rutile concentrate shipments from 93 to 94 percent TiO_2.

[1] Engineering and Mining Journal, Court Decree Sustains Titanium Trust Charges: Vol. 146, No. 8, August 1945, p. 106.

Production and mine shipments of titanium concentrates from domestic ores in the United States, 1941–45

Year	Ilmenite				Rutile			
	Production (short tons)	Shipments			Production (short tons)	Shipments		
		Gross weight (short tons)	TiO_2 content (short tons)	Value		Gross weight (short tons)	TiO_2 content (short tons)	Value
1941	23,297	21,526	9,930	$196,522	3,130	3,431	3,192	$493,782
1942	77,208	93,397	41,328	1,805,823	2,648	2,649	2,466	410,956
1943	203,551	211,715	94,283	3,738,970	3,987	3,941	3,639	610,879
1944	278,610	280,791	128,095	7,371,279	6,922	6,770	6,312	1,088,112
1945	308,516	308,518	141,852	7,359,170	7,179	6,837	6,414	869,920

Arkansas.—Titanium ore was not mined in Arkansas in 1945. The property of the Magnet Cove Rutile Co., Malvern, Hot Spring County, which ceased production in July 1944, was examined by the Bureau of Mines, and several churn-drill holes were put down.

Florida.—Rutile, ilmenite, and zircon were produced near Jacksonville by Humphreys Gold Corp., operating under lease from Rutile Mining Co. and its parent company, Titanium Alloy Manufacturing Co. Riz Mineral Co. mined rutile, ilmenite, and zircon from sands near Vero Beach and concentrated the product at its plant near Melbourne.

New York.—Production of ilmenite by the National Lead Co. at Tahawus, Essex County, increased 11 percent in 1945 compared with 1944. The geology of the deposit was described by Stephenson.[2] Some operational details from two other recent reports are quoted below.

The National Lead Co. at Tahawus, N. Y., operated throughout the year mining approximately 2,000,000 long tons; of this about 1,300,000 was crushed to produce more than 1,000,000 long tons of mill feed. Ilmenite production amounted to about 220,000 long tons and magnetite production to about 400,000. A portion of the magnetite (108,069 long tons) was sintered for shipment to blast furnaces. Additional shovels and trucks were purchased to facilitate stripping operations in the open-cut mine. A pilot plant was installed in the mill to confirm laboratory flotation tests for the recovery of fine ilmenite heretofore lost in the plant tailing. As during 1944, the principal problem was one of manpower. It was necessary to resort to Barbados Islanders whose contract, however, terminated at the end of the war. An agreement was then made with immigration authorities which permitted the hiring of Canadians. Without these measures it would have been impossible to keep in operation.[3]

Output in 1944 reached approximately 220,000 short tons. Plant enlargements completed during 1944 increased annual capacity to around 270,000 tons for 1945. Flotation tests indicate that improved recovery and grade of ilmenite concentrates can be obtained by flotation methods as compared to table concentration and Wetherill magnetic cleaning of the tailing from the Crockett magnetic separators. An acid circuit enhances the selective action of the collector for the ilmenite. . . . The success of the United States titaniferous magnetite mining now that the war has ended with Indian ilmenite returning to the competitive picture may depend greatly on ability to dispose of the magnetite concentrate produced in the amount of two tons for each ton of ilmenite concentrate. The magnetite concentrate is low in sulfur and practically free from phosphorus but carries nearly 10 percent TiO_2 in New York ores. Tests indicate that blending with about four

[2] Stephenson, Robert C., Titaniferous Magnetite Deposits of the Lake Sanford Area, New York: Am. Inst. Min. and Met. Eng. Min. Technol., vol. 9, No. 1, January 1945, Tech. Pub. 1789, 25 pp.
[3] Linney, J. R., Eastern Magnetite: Min. and Met., vol. 27, No. 470, February 1946, p. 85.

parts of nontitaniferous ores dilutes the titanium to a point at which no harmful effects result to smooth blast-furnace operation. Titanium from the Adirondacks and elsewhere will be needed for some time to come as protection to assure the pigment plants of the United States a source of supply and by careful management it is likely that titanium ore from American properties can be produced at a cost to compete with Indian ore.[4]

North Carolina.—The Yadkin Valley Ilmenite Co., subsidiary of the Glidden Co., at Finley, Caldwell County, produced 17,641 short tons of ilmenite (averaging 53 percent TiO_2) in 1945 compared with 14,908 tons in 1944. On January 22, 1946, the State Board of Conservation and Development approved broadening of a contract with E. I. duPont de Nemours Co., Inc., which will permit the company to prospect for ilmenite in all sounds and rivers in the State's coastal area as far south as Cape Fear River.[5]

Oregon.—Magnetometer surveys, made in 1942, of black sands along the Oregon coast were published in 1945.[6] The size, shape, magnetism, and mineral content of the sands were analyzed.[7] Efforts were made to work these deposits during World War II, and some chromite was shipped in 1943 (see Minerals Yearbook, 1943, pp. 629–630). However, due to the low grade of the products, operations were considered unsuccessful; there was no output of accessory titanium concentrates of commercial grade.

Virginia.—American Rutile Corp., subsidiary of Metal and Thermit Corp., produced rutile and ilmenite near Roseland, Nelson County. Ilmenite was produced at Piney River, Nelson County, by the Calco Chemical Division of American Cyanamid Co., which took over the mine and mill property from Virginia Chemical Co. in March 1945. The extent of the Piney River ore body was investigated in early 1944 by completing 44 drill holes to an average depth of 110 feet.[8] In June the Calco Chemical Division purchased the Gloucester City, N. J., plant of the Sherwin-Williams Co., for production of titanium dioxide.

FOREIGN TRADE[9]

Imports.—Principally as a result of increased availability of Indian concentrates, imports of ilmenite in 1945 were almost double those of 1944 and equaled 73 percent of the 1939 high. Small Norwegian entries were the first since 1936. Imports of rutile, almost exclusively from Australia, were at the same level in 1945 as in 1944. Brazilian rutile entries continued to decline. Titanium is imported from Australia only in the form of mixed zircon-rutile-ilmenite concentrates, which are separated into their component minerals by the International Titanium Corp. (subsidiary of the American Rutile Corp. and Ventures, Ltd.), Carteret, N. J.; Orefraction, Inc., Pitts-

[4] Herres, Otto, Titanium—a Growing Industry: Min. and Met., vol. 27, No. 472, April 1946, pp. 210–212.
[5] Engineering and Mining Journal, vol. 147, No. 3, March 1946, p. 118.
[6] Stephenson, E. L., Magnetometer Surveys of Black Sands of the Oregon Coast: Bureau of Mines Rept. of Investigations 3814, 1945, 18 pp.
[7] Twenhofel, W. H., Beach and River Sands of the Coastal Region of Southwest Oregon, with Particular Reference to Black Sands: Am. Jour. Sci., vol. 224, No. 2, February 1946, pp. 114–139; No. 3, March 1946, pp. 200–214.
[8] Davidson, D. M., Diamond-Drill Sludge Sampling and Appraisal of a Weathered Ilmenite Ore Body, Piney River, Virginia: Am. Inst. Min. and Met. Eng. Min. Technol., vol. 10, No. 1, January 1946, Tech. Pub. 1951, 5 pp.
[9] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

burgh, Pa.; and Titanium Alloy Manufacturing Co., Niagara Falls, N. Y. Small quantities of ferrotitanium have been imported occasionally, but none since 1939.

Titanium concentrates [1] imported for consumption in the United States, 1941–45, by countries, in short tons

Country of origin	1941	1942	1943	1944	1945
ILMENITE					
Australia [2]	364	235	390	79	1,753
Brazil	3,709	1,287		5,511	10,508
Canada	5,725	4,540	65,437	32,580	6,981
Ceylon				4,648	
India and Dependencies	156,079	1,165	8,960	62,066	179,693
Norway					9,895
Portugal	969				
Total as reported	166,846	7,227	74,787	104,884	208,830
Australia: In "zirconium ore" [2]	3,843	3,180	3,306	4,064	[3] 1,236
Grand total	170,689	10,407	78,093	108,948	210,066
Value of "As reported"	$629,940	$60,490	$380,161	$596,034	$1,217,317
RUTILE					
Australia [2]	666	1,311	2,802	1,896	3,070
Brazil	2,448	4,966	4,920	1,669	234
Cameroun (French) [4]		146	1,095		
India and Dependencies			818	134	
Total as reported	3,114	6,423	9,635	3,699	3,304
Australia: In "zirconium ore" [2]	3,177	4,102	4,703	6,320	7,298
Grand total	6,291	10,525	14,338	10,019	10,602
Value of "As reported"	$306,176	$623,917	$823,624	$272,283	$98,170

[1] Classified as "ore" by the U. S. Department of Commerce.
[2] All imports of titanium from Australia in 1941–45 were in mixed zircon-rutile-ilmenite concentrates. Totals of mixed concentrates are derived by addition of the U. S. Department of Commerce figures for imports of ilmenite, rutile, and "zirconium ore" from Australia. These totals are apportioned by the Bureau of Mines (on the basis of surveys of importers) into the three component minerals. The excess quantities of ilmenite and rutile over the quantities reported by the U. S. Department of Commerce in those specific categories are entered as "In 'zirconium ore.' "
[3] Includes 309 tons not recovered from mixed concentrates.
[4] Includes quantities reported by the U. S. Department of Commerce as originating in French Equatorial Africa, from which no rutile production has been recorded.

Exports.—Titanium products valued at 2.6 million dollars were exported in 1945. Of the concentrates (probably mostly rutile) 74 percent went to Canada, 11 percent to Union of South Africa, and 8 percent to Belgium. Of the pigments, 83 percent went to Canada and 14 percent to Latin America (mainly Brazil, Cuba, Mexico, and Argentina). Most of the other compounds and ferro-alloys likewise reached the Canadian market.

Exports of titanium products from the United States, 1941–45, by classes

Year	Concentrates		Ferro-alloys [1]		Dioxide and pigments		Tetrachloride and other compounds	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	[2] 432	[2] $70,613	[2] 150	[2] $35,687	7,821	$1,609,071	[3] 17	[3] $5,792
1942	618	117,886	422	60,938	8,870	1,707,433	24	13,666
1943	576	103,947	760	117,402	9,765	1,830,344	728	442,591
1944	291	51,828	793	127,145	10,925	1,851,457	375	215,696
1945	609	121,951	744	122,887	12,824	2,315,552	75	46,718

[1] Includes metal and nonferrous alloys, 1941–44.
[2] Data cover last 6 months only.
[3] Data cover last 4 months only.

STOCKS

Ilmenite and rutile stocks inci eased 63 and 45 percent, respectively during 1945.

Stocks of titanium concentrates in the United States at end of year, 1944–45, in short tons

Stocks	1944				1945			
	Ilmenite		Rutile		Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
Mine	1, 572	722	252	236	1, 570	774	594	558
Distributors [1]	4, 542	2, 316	2, 532	2, 380	6, 780	3, 254	4, 064	3, 739
Consumers	161, 572	72, 814	1, 720	1, 570	264, 248	131, 732	1, 581	1, 464
Government			2, 500	2, 350			3, 891	3, 658
Total stocks	167, 686	75, 852	7, 004	6, 536	272, 598	135, 760	10, 130	9, 419

[1] Includes ilmenite and rutile content of mixed zirconium-titanium concentrates.

CONSUMPTION AND USES

Consumption of ilmenite advanced 6 percent in 1945 compared with 1944 and would have shown greater gain if the needed expansion of pigment-manufacturing facilities could have been built. Consumption for pigments was 98 percent of the total, most of the remainder going into alloys and cemented carbides. Rutile, whose consumption declined one-third, was used primarily in welding-rod coatings (80 percent) and alloys and carbides (nearly 20 percent).

Consumption of ilmenite and rutile in the United States, 1944–45, by products, in short tons

Product	Ilmenite		Rutile	
	Gross weight	Estimated TiO_2 content	Gross weight	Estimated TiO_2 content
1944				
Pigments (manufactured titanium dioxide) [1]	349, 505	170, 518		
Welding-rod coatings [1]	148	82	10, 747	10, 103
Alloys and carbide	10, 174	4, 401	4, 014	3, 683
Ceramics			20	20
Miscellaneous [2]	1, 114	474	32	31
Total consumption	360, 941	175, 475	14, 813	13, 837
1945				
Pigments (manufactured titanium dioxide) [1]	371, 691	183, 195		
Welding-rod coatings [1]	115	62	7, 813	7, 344
Alloys and carbide	8, 611	3, 976	1, 923	1, 750
Ceramics			34	30
Miscellaneous [2]	761	347	21	20
Total consumption	381, 178	187, 580	9, 791	9, 144

[1] "Pigments" include all manufactured titanium dioxide, consumption of which in welding-rod coatings was 3,900 tons in 1944 and 2,258 tons in 1945.
[2] Consists of ilmenite used as a steel flux and rutile used in lamp-electrode coatings and as a steel deoxidizer.

Titanium pigments.—Production and sales of titanium pigments climbed to another high in 1945, but demand continued greatly to exceed supply. The Bureau of Mines is not at liberty to publish pertinent figures. Distribution of pigment supplies was controlled by War Production Board Limitation Order M–353, which was revoked March 26, 1945, and replaced simultaneously by General Preference Order M–340. Under Civilian Production Administration (which succeeded War Production Board November 3, 1945) Priorities Regulation 28, manufacturers of titanium pigments January 16, 1946, were assigned CC ratings, highest obtainable for civilian goods, to enable them to expand capacity about 20 percent by late 1946. Titanium paints are noted for covering power, whiteness, and durability. Since 1939 titanium dioxide has been utilized in greater quantities than any other white pigments. Paint requirements of the Navy and Merchant Marine for maintenance of the active fleet and ships in reserve continued to be large throughout 1945. The pattern of sales distribution of titanium pigments in 1945, according to a large manufacturer, was 75 percent for paint, varnish, and lacquer, 10 percent for paper, 2 percent each for floor coverings and rubber, 1½ percent each for welding-rod coatings and textiles, and 8 percent for other uses.

Welding-rod coatings.—Production of titanium-coated welding rods was 267,000 short tons in 1945 compared with 382,000 tons in 1944. Of these rods, 46 percent were coated with manufactured titanium dioxide (extracted from ilmenite), 42 percent with natural rutile, 10 percent with both varieties of dioxide, and 2 percent with ilmenite. Decline in welding-rod output was due primarily to curtailment of fabrication of ships and tanks, particularly after cessation of war August 1945.

Titanium alloys.—Ferrocarbontitanium (15–20 percent Ti, 3–8 percent C) is a deoxidizer and scavenger in steel melts, and ferrotitanium (18–45 percent Ti, 0.1 percent C max.) inhibits intergranular corrosion and promotes hardenability of steel.[10] Recently developed titanium steels suitable for one-coat vitreous enameling can be improved in yield strength by the addition of 1.5 percent manganese and 0.5 percent each silicon, copper, and nickel.[11] The combustion chamber of some jet aircraft engines is constructed of nickel-chromium alloy containing 3 percent Ti.[12]

Other uses.—Pure titanium metal has been produced experimentally and, in view of its useful properties and the abundance of its ores, has a promising future as a structural material (see Technology section of this chapter). Sintered titanium carbide is used to tip tool steels. High-titania glasses have a refractivity comparable to lead glasses and do not have the disadvantageous high density and low resistance to abrasion of the latter.[13]

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[10] Comstock, G. F., The Influence of Titanium in the Hardenability of Steel: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 12, No. 6, September 1945, Tech. Pub. 1904, 15 pp.

[11] Comstock, George F., Some Interesting Properties of Titanium Steels: Jour. Am. Ceram. Soc., vol. 29, No. 1, January 1, 1946, pp. 1–7.

[12] Steel, Secrecy Partially Lifted on Jet Aircraft Engines: Vol. 117, No. 18, October 29, 1945, p. 94.

[13] Colbert, William, Comparison of Effect of TiO_2, and PbO on Refractive Index of Glasses: Jour. Am. Ceram. Soc., vol. 29, No. 2, February 1, 1946, pp. 45–47.

PRICES

No price changes affected any form of titanium in 1945. Ilmenite and rutile prices were fixed by the Office of Price Administration February 22, 1943 (Regulation 327), at levels prevailing in March 1942. Ilmenite, 60 percent TiO_2, was nominally quoted at \$28–\$30 a long ton, f. o. b. Atlantic seaboard, and rutile, 94 percent TiO_2, at 8–10 cents a pound. Steel quoted ferrotitanium, ton lots, at \$1.23 per pound of contained Ti for 40- to 45-percent grade and \$1.35 for 20- to 25-percent grade; and ferrocarbontitanium, 15–20 percent Ti, at \$142.50 a short ton for 6- to 8-percent carbon and \$157.50 for 3- to 5-percent carbon. Titanium metal, 96–98 percent, was listed at \$5–\$5.50 a pound. The base price of manufactured titanium dioxide remained fixed at 14½–16½ cents a pound.

TECHNOLOGY

Production, fabrication, and properties of pure titanium metal were investigated by the Bureau of Mines. The metal was prepared by the Kroll process, which involved reducing titanium tetrachloride by magnesium at about 800° C. Magnesium chloride and unreacted magnesium were leached out with cold hydrochloric acid, and the resulting granular titanium was consolidated by pressing into compacts at a pressure of 50 tons per square inch and sintering at 1,000° C. in a vacuum. These compacts were found to be ductile and suitable for fabricating into sheet and bar by commercial methods. Annealed material had a tensile strength of about 82,000 pounds per square inch, with 28 percent elongation and a Rockwell hardness of A–55. Tensile strength for 50-percent reduction by cold-working is about 126,000 pounds per square inch, with 4 percent elongation and a Rockwell hardness of A–65. The metal has excellent corrosion resistance comparable to 18–8-type stainless steel.[14] [15]

WORLD PRODUCTION

Data on world production of ilmenite and rutile in recent years are shown in the following table.

Australia.—The bulk of the Australian titanium output is in the form of mixed zircon, rutile, and ilmenite mined and concentrated on the beaches of New South Wales and Queensland and shipped to the United States for separation and consumption. An English company is planning to build near Burnie, northern Tasmania, a plant costing A£250,000 to manufacture titanium pigments from Indian ilmenite.[16]

Cameroun (French).—Improvements to hitherto rudimentary plants

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[14] Dean, R. S., Long, J. R., Wartman, F. S., and Anderson, E. L., Preparation and Properties of Ductile Titanium: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 13, No. 2, February 1946, Tech. Pub. 1961, 13 pp.

[15] Dean, R. S., Long, J. R., Wartman, F. S., and Hayes, E. T., Ductile Titanium—Its Fabrication and Physical Properties: Am. Inst. Min. and Met. Eng. Metals Technol., vol. 13, No. 2, February 1946, Tech. Pub. 1965, 17 pp.

[16] Mining Magazine (London), vol. 73, No. 2, August 1945, p. 102.

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World production of titanium concentrates (ilmenite and rutile), 1938–45, by countries, in metric tons

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
ILMENITE								
Australia:								
New South Wales	330	683	1,538	3,521	3,651	3,815	3,590	(1)
Queensland	-------	-------	-------	258	937	1,902	3,697	(1)
Brazil (exports)	155	10	12	4,471	-------	-------	3,250	5,000
Canada	188	3,351	4,114	11,477	9,100	62,992	30,820	12,071
Egypt	90	-------	465	2	[2] 691	-------	9	9
Federated Malay States (exports)	6,462	11,098	2,596	(1)	(1)	(1)	(1)	(1)
India, British	256,268	(1)	267,376	131,111	49,977	38,041	(1)	(1)
Norway	49,181	55,027	(1)	61,086	60,713	(1)	(1)	(1)
Portugal	568	502	899	798	-------	121	-------	301
Senegal [3]	8,436	4,268	7,082	1,000	4,840	730	(1)	(1)
Spain	-------	-------	-------	71	85	178	548	(1)
United States	(4)	13,247	18,750	21,135	70,042	184,657	252,749	279,880
RUTILE								
Australia:								
New South Wales	[5] 457	716	1,641	3,549	4,496	4,828	4,597	(1)
Queensland	-------	-------	-------	267	1,007	1,655	4,246	(1)
South Australia	8	2	2	(6)	(1)	(1)	(1)	(1)
Brazil (exports)	377	489	499	2,369	4,615	4,557	1,564	160
Cameroun, French (exports)	118	160	503	1,399	2,153	2,750	2,902	(1)
Norway	124	166	156	172	77	116	(1)	(1)
South-West Africa	-------	-------	-------	(1)	(1)	-------	(1)	(1)
United States	(4)	(4)	2,620	2,839	2,402	3,617	6,279	6,513

1 Data not available.
2 Includes 26 tons of garnet-ilmenite.
3 Approximately 20 percent of ilmenite concentrates is zircon.
4 Bureau of Mines not at liberty to publish figures.
5 In addition, 98 tons of zircon-rutile-ilmenite concentrates were produced in 1938.
6 Less than 1 ton.

are hoped to result in an output of 3,500 tons of ilmenite and increased quantities of rutile in 1946.[17]

Canada.—Canadian Titanium Pigments, Ltd., of Montreal is reported to be planning construction of a plant at Cap de la Madeleine, Quebec, estimated to cost $7,000,000.[18]

India.—The two leading ilmenite producers interrupted their operations in 1945; Travancore Minerals Co., Ltd., ceased operations about the middle of the year, and Hopkins & Williams (Travancore), Ltd., shut down its plant temporarily after expiration of its mining lease September 6.[19]

United Kingdom.—British Titan Products Co., Ltd., pigment manufacturer at Billingham-on-Tees, England, has tripled its nominal capital to £1,125,000.[20] Indian ilmenite, 52–54 percent TiO_2, was quoted by Metal Bulletin at about 30s. per long ton, f. a. s., during 1945. Official prices for rutile, f. o. b. consumers' works, remained fixed throughout the year at £45–£50 a long ton for Australian concentrates, £42–£50 for Indian concentrates, and £54–£60 for Cameroun concentrates. Ferrotitanium cost £100 a long ton for the 2- to 3-percent-carbon grade (20 to 25 percent Ti) and 1s. 3½d. per pound for the carbon-free grade.

17 Chemical Age (London), vol. 54, No. 1391, February 23, 1946, p. 220.
18 Canadian Chemistry and Processing Industries, vol. 30, No. 1, January 1946, p. 60.
19 Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 1, February 20, 1946, p. 21.
20 Abrahamson, G., Titan Raises Capital: Chem. and Eng. News, vol. 24, No. 5, March 10, 1946, p. 697.

MINOR METALS

By C. E. NIGHMAN[1]

SUMMARY OUTLINE

INTRODUCTION

Literally and figuratively bringing world-wide consequences was the detonation of so-called atomic bombs on August 5, 1945, over Hiroshima and on August 8 over Nagasaki, Japan.[2] Within a few days, Japan sought peace terms and on September 2, 1945, signed an unconditional surrender that brought World War II to a close. Thus dramatically was revealed the first great result of the intense labors of an extraordinary aggregation of the world's outstanding scientists, and of an army of technicians and skilled and unskilled workers who planned, constructed, and operated the vast plants that produced the explosive elements. At a cost of over 2 billion dollars there had been produced a minute quantity—probably not over a few hundreds of pounds—of materials, the explosive power of which was virtually beyond conception. The materials, not isolated before 1940, were the isotope of uranium, U^{235}, and the hitherto unknown element plutonium, in particular the relatively stable isotope, Pu^{239}. Both were obtained or derived from ordinary uranium which, since its discovery more than one and a half centuries ago, had been considered, in terms of quantity produced or value, only a minor metal; it now stands in the front rank if not supreme among the metals.

The atomic bomb, a practical application of principles of pure science, proved to be the most revolutionary military weapon ever developed, and the means and methods of its production were an engineering triumph.[3] In the space available it is not possible to list even the more important scientific developments that followed the discovery of radio-activity at the turn of this century, with the subsequent development of modern concepts of the constitution of matter. The fantastic possibilities of destruction that appeared from application of Einstein's equation of the equivalence of energy and mass to the results of what early in 1939 was correctly recognized to be nuclear fission directed attention to the military possibilities of this phenomenon in view of the increasing certainty that another world war impended.

At the instance of a group of military officials and scientists, in-

[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] The first test bomb was exploded July 16, 1945, on the proving ground near Alamagordo, N. Mex.

[3] Much of the discussion in this chapter is based on what is generally called the Smyth report, an officially approved document by H. D. Smyth entitled "A General Account of the Development of Methods of Using Atomic Energy for Military Purposes Under the Auspices of the United States Government, 1940–45." This document first appeared in a limited mimeographed War Department release for use of radio commentators after 9 p. m. August 11, 1945, and for the morning papers of Sunday, August 12. It was issued subsequently in printed editions by Princeton University and by the Government Printing Office. An approved popular account by William L. Laurence appeared in the New York Times and was issued later by that newspaper in a 40-page pamphlet entitled "The Story of the Atomic Bomb." Abstracts or condensations of the Smyth report appeared in all leading technical journals, magazines, and newspapers within a few months after the original release date. Release of additional information is expected in 1946 after study by a special War Department Declassification Committee.

cluding Einstein,[4] the late President Roosevelt set up, in the fall of 1939, an advisory committee on uranium that later became part of the National Defense Research Committee and then after reorganization was incorporated in the Office of Scientific Research and Development. Contracts were concluded with several universities and the Bureau of Standards to carry out special basic research, but up to the end of 1941 commitments were only about $300,000. The attack on Pearl Harbor and knowledge that the Germans were working intensively on the atomic bomb problem made acceleration and expansion of the program imperative. In midsummer 1942 the Army Corps of Engineers set up a special organization to carry on the work. This was designated the Manhattan District and the project, for security reasons, was named the Development of Substitute Materials. In September 1942 Gen. Leslie R. Groves was placed in complete charge of all Army activities and continued so to act into 1946. After May 1, 1943, the Manhattan District was in full control of all phases of the project.

By the end of 1942 there was considerable evidence that atomic explosives could be prepared. Basic raw materials of requisite purity were becoming available. In December the first self-sustaining graphite-uranium fission pile was in operation. A microscopic quantity of the element, plutonium, had been isolated and many of its properties, including fissionability, determined. The chemistry of its separation from uranium and fission products was known. Plans for construction of full-scale plants had been drawn up. It is worthy of note that, except for a pilot uranium-graphite pile that was set up at the Clinton Engineer Works in Tennessee, the tremendous U^{235} and plutonium operating plants were constructed without recourse to the standard engineering practice of pilot-plant design and operation. In 1943–44 hundreds of square miles of land were acquired and plants erected for U^{235} separation near Knoxville, Tenn., for the plutonium production at Hanford in eastern Washington, and for the metallurgical and bomb laboratories at Los Alamos near Sante Fe, N. Mex. Although a military project, the personnel was nearly all civilian, and the construction and operation were carried out by or under the supervision of outstanding industrial organizations. In fact, a large cross-section of American industry participated directly or indirectly in the project. Its contribution, accompanied by the intensive endeavors of scientists from many lands that culminated in the atomic bombs, was one of the greatest cooperative achievements ever recorded.

Scarcely had the first joy at the cessation of conflict subsided before public attention was focused on the world-wide political and social implications of the possession of this virtually incomprehensible power. Its control became at once a matter of supreme international gravity. How could it be directed to the welfare of mankind and not to its annihilation? Interested groups made proposals concerning the revelation of still secret information that ranged from one extreme to the other. The first official pronouncement was contained in a joint declaration by the President of the United States and the Prime Ministers of the United Kingdom and Canada, signed at Washington

[4] In a letter dated August 2, 1939, Einstein wrote the President: "Some recent work by E. Fermi and L. Szilard * * * leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. * * * This new phenomenon would also lead to the construction of bombs * * * extremely powerful bombs."

November 15, 1945. Therein was expressed a willingness to share fundamental scientific information with any fully reciprocating nation. Likewise, information on methods and processes equally applicable to humanitarian or military use would be released, but only when adequate safeguards against misuse were provided. To these ends, to eliminate atomic weapons from armaments and to establish the requisite controls a commission should be set up at once in the United Nations Organization. Such a commission was established, but it had made public no recommendations at the time this chapter was written. In the United States and in other countries atomic control legislation has been proposed. Final action has not been taken; but there is some indication in this country that controls will be vested largely, if not fully, in civilian rather than in military hands.

BARIUM AND STRONTIUM

Production of barium and strontium metals and their alloys in the United States in 1945 was slightly less than in 1944 largely because of a recession in the wartime expanded needs for radio and radionic tubes. A possible deterent to broader application has been the high price, which for barium has been above $5 a pound and for strontium about three times as much. Although barium ranks tenth in abundance among the constituents of the igneous rocks, its great affinity for fluorine, chlorine, oxygen, nitrogen, hydrogen, and sulfur has made its reduction a difficult and expensive process. In the light of recent experience in the production of magnesium by the reduction of dolomite with ferrosilicon, Kroll[5] reviewed various processes and modifications and concluded that on a large-scale operation basis metal could be produced for less than 45 cents a pound. The report contains an extensive bibliography.

Of extraordinary subsequent import was the discovery in 1939 that among the products resulting from the neutron bombardment of uranium were isotopes of barium and lanthanum, elements that lie roughly in the midsection of the periodic table. This was an entirely new development. Although nearly all the elements had been caused to disintegrate by particle bombardment, the most massive particle torn loose from a nucleus was an alpha particle or helium nucleus of atomic number 2 and atomic mass 4. It was thus established that nuclear fission (that is, a splitting into roughly equal parts) could be effected and the energy released would far surpass any theretofore observed in other atomic disintegrations.

BERYLLIUM

Consumption of beryllium ore in 1945 was nearly one-fourth less than in 1944, a large part of the drop taking place in the fourth quarter. The receipt of foreign ores was about 40 percent that of 1944, but total stocks in the United States were not greatly reduced. Residual restrictions on use of beryllium metal were lifted by revocation of War Production Board General Preference Order M–160 on May 29, 1945. Order M–160–a, covering segregation and sale of beryllium scrap, was revoked on April 23, 1945, and imports of beryllium ore, metal, and salts were removed from control on June 4, 1945, by an amendment to WPB General Imports Order M–63.

Domestic mine production.—Shipments from mines dropped sharply in 1945 from the peak level of 1944. This was to be expected when

[5] Kroll, W. J., Processes for Making Barium and Its Alloys: Bureau of Mines Inf. Circ. 7327, 1945, 16 pp.

Government purchasing at roughly three times the immediate prewar price was discontinued at the end of 1944, with the accompanying contraction in demand for beryllium products that began in 1943. It appears that domestic beryl output cannot meet requirements even with strong price support.

Beryllium ore shipped from mines in the United States, 1939–45, by States, in short tons

[Compiled by R. W. Metcalf]

	1939	1940	1941	1942	1943	1944	1945
Colorado	(1)	(1)	----------	3	68	35	----------
Maine	(1)	(1)	(1)	45	2	2	----------
Massachusetts	----------	----------	----------	----------	(1)	4	----------
New Hampshire	----------	----------	(1)	16	42	(1)	1
New Mexico	----------	----------	----------	----------	(1)	29	----------
South Dakota	84	74	151	205	238	306	38
Other [2]	11	47	7	----------	6	12	----------
Total:							
Short tons	95	121	158	269	356	388	39
Value	$2,720	$3,721	$7,300	$24,188	$44,407	$56,135	$6,133
Average per ton	$28.63	$30.75	$46.20	$89.92	$124.74	$144.67	$157.26

[1] Included under "Other." Bureau of Mines not at liberty to show separately.
[2] Figures cover—1939 and 1940: Colorado, Maine; 1941: Maine, New Hampshire, Wyoming; 1943: Massachusetts, New Mexico, North Carolina, Virginia; 1944: Connecticut, New Hampshire, North Carolina, Virginia.

Foreign trade.—Imports of beryl ore were only 38 percent as great as in 1944, when the Government's foreign purchase program ceased; but a portion of the 1945 entries comprised shipments of ores actually produced in 1944. This was particularly true in Africa and Australia, and it is not expected they will be future consequential suppliers, except at very high price. Exports in 1945 were 172 pounds of ore ($130) and 103,129 pounds of metal, alloys, and scrap ($85,849). The quantity and value of salts and compounds no longer are classified separately.

Beryllium ore imported for consumption in the United States, 1941–45, by countries, in short tons

Country	1941	1942	1943	1944	1945
Africa:					
British:					
British East Africa	----------	----------	----------	15	7
Southern Rhodesia	----------	----------	----------	7	----------
Union of South Africa	----------	38	86	(1)	----------
Anglo-Egyptian Sudan	----------	----------	----------	1	----------
Argentina	861	703	1,162	229	----------
Australia	----------	----------	457	518	105
Brazil	1,805	912	2,551	1,453	572
India and Dependencies	----------	397	509	892	484
Madagascar	----------	----------	74	----------	11
Nigeria	----------	----------	----------	----------	22
Portugal	----------	----------	1	----------	----------
Total: Short tons	2,666	2,050	4,840	3,115	1,201
Value	$143,992	$137,597	$377,726	$286,091	$131,841

[1] Less than 1 ton.

Stocks.—Consumers and dealers held only 90 tons of ore at the year end. Office of Metals Reserve held 4,497 short tons, a reduction of 187 tons during the year.

Prices.—The price of $14.50 a short-ton unit, 8–12 percent BeO content, set by the then Metals Reserve Co. in May 1944, continued to be quoted by trade journals until June 1945. Immediately after controls were lifted near midyear 1945, quoted prices dropped to $9–$10 a unit which prevailed to the year end. Beryllium-copper master alloy was quoted at $15 a pound contained Be throughout the year against a ceiling price of $17. In February 1946 the Beryllium Corp. announced a price of $14.75 and on the 5-percent Be master alloy for use in aluminum castings a price of $30 a pound contained Be in 1,000-pound lots compared with the former price of $47. Beryllium metal was priced at about $45 a pound.

Uses.—Study in 1930–32 of a highly penetrating radiation arising from the bombardment of beryllium with an alpha particle from polonium (a radium disintegration product) led to the discovery of a new, fundamental physical particle, the neutron. Its principal characteristic, the absence of electric charge, makes it an extremely effective atomic disintegration "bullet," especially with heavy, highly charged atoms. Although uranium may be disintegrated by other particles; the neutron reaction is of great moment in that a fission may provide, on the average, more than one secondary neutron which may, in turn, effect other fissions, thus establishing a continuing or chain reaction.

There is no natural neutron supply and although there are several reactions that provide neutrons the most commonly used is that of radium and beryllium. This reaction was used to measure neutron intensity at various points and with different arrangements of uranium and moderator in the experimental reaction piles, and it furnished the excess neutrons required to initiate the reaction in the first self-maintaining pile. However, contrary to some statements, the radium-beryllium mixture was not used in the later operating or production piles. In them, reaction was initiated by spontaneous uranium fission or by cosmic rays.

Beryllium was suggested for use as a moderator (see Boron section) because it has a low atomic weight and low neutron-absorption cross section, as well as being a possible source of additional neutrons that arise when it is bombarded by neutrons. Experimental use indicated that beryllium was comparable to graphite as a moderator, but in practice it found little use because it could not be procured in quantity of the requisite purity and structural form, aside from its high unit cost.

To maintain a chain reaction, more neutrons must be available than escape from the reacting mass plus those ineffective in producing fission. Escape is a surface effect and could be limited in part by enclosing the reaction piles in a reflecting material. Experimentally, at least, beryllium was so used, though graphite (carbon) appears to have been employed as a reflector in the production piles.

Beryllium enters into fabrication in several forms—as beryllium-copper alloys, as the oxide, as metal, in chemicals, and to a very minor extent as beryllium-nickel or beryllium-aluminum. Metal production was not large, at least up to 1941; the Smyth report states that in 1940 only 700 pounds were made in this country. It appears from preceding paragraphs that the special war uses probably induced a much larger output in the following years. The major metal use and a growing one because of the spreading employment of industrial radiography has been for windows on X-ray tubes,[6] where it has special value in permitting the passage of "soft" or long wave-length radiation. Beryllium oxide or zinc beryllium silicate is used as a phosphor, giving

[6] Zunick, M. J., Metallurgical Aspects of X-Ray Tube Manufacture: Iron Age, vol. 157, No. 15, Apr. 11, 1946, pp. 56–59. Several references to beryllium use are given.

a yellow-white light in fluorescent lamps. In 1945 production of fluorescent lamps was about 37 million units, with an expected output of 50 million by 1950. Another growing use of the oxide is for refractory crucibles and shapes. In the past, many commercially unsuccessful attempts were made to develop strong, light alloys with aluminum or magnesium. Recently, however, it has been found that certain binary and ternary aluminum alloys, particularly the latter, to which beryllium has been added, age-harden and are remarkably corrosion-resistant at high temperature. A new outlet for beryllium may follow. The outstanding use has remained in copper-beryllium alloys, which are finding an increasing range of applications because of unusual properties.[7]

Technologic developments.—The Bureau of Mines carried out further tests on concentration of beryl ores. Flotation patents [8] were granted Bureau of Mines technicians. A description and analysis of methods for production of beryllium and alloys, with an extensive bibliography of processes and patent literature, was published.[9] Heat-treating methods for springs and parts made from beryllium copper strip or wire were described,[10] as were schemes for surface hardening with retention of softer, tougher, and more ductile interior section of more massive bodies, such as tools, gears, and other articles.[11] A method for reduction of beryllium fluoride materials by magnesium to produce metallic beryllium of high purity was also patented.[12]

World production.—The subjoined table gives world production of beryllium ore. World output in 1945 slumped 75 percent compared with 1944; dropped 83 percent compared with the peak year 1943; and was apparently little more than the prewar 1935–39 average. The pronounced decline in 1945 was primarily the result of the termination of the war-stimulated world-wide buying program of the United States Government. The effects on production in the several producing countries is noted in the following foreign review.

World production of beryllium ore, 1938—45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	753	299	520	2,186	925	530	348	[2] 40
Australia		6	2	3		534	417	(3)
Brazil (exports)	203	276	1,472	1,703	1,634	2,027	1,185	510
India and Dependencies	18	9	53	(4)	121	1,486	[2] 1,000	[2] 250
Madagascar (estimated exports)	2	(3)	(3)	(3)	(3)	[5] 67	(3)	[5] 10
Portugal	27	(3)	(3)	35	(3)	14	[2] 60	(3)
Portuguese East Africa	(3)	(3)	(3)	(3)	8	6	3	(3)
Spain			4	(3)	(3)	(3)	(3)	(3)
South-West Africa	(3)	(3)	(3)	20	39	36	1	5
Uganda	(3)	(3)	(3)	(3)	(3)	(3)	18	4
Union of South Africa (estimate) [5]	(3)	(3)	5	(3)	34	78	(3)	(3)
United States (mine shipments)	23	86	110	143	244	323	352	35
Total reported	1,026	676	2,166	4,090	3,005	5,101	3,384	854

[1] In addition to countries listed, beryllium ore may also be produced in Finland, France, Italy, Kenya, Norway, Rumania, and U. S. S. R. Canada has produced beryl but reported no sales.
[2] Estimate. [3] Data not available. [4] Less than 1 ton. [5] Estimate based on United States imports.

[7] Yarham, E. R., Beryllium-Copper: Iron Age, vol. 155, No. 17, Apr. 26, 1945, pp. 63–67. Williams, H. C., Beryllium-Copper—Its Uses and Potentialities: Steel, vol. 118, No. 19, May 13, 1946, pp. 88–91, 142, 144, 146.

[8] Lamb, Frank B., and Banning, L. (to Secretary of the Interior), Beneficiation of Beryllium Ores: U. S. Patent 2,385,819, Oct. 2, 1945. Gibbs, H. L., and Sneddon, H. D., same title and assignment: U. S. Patent 2,395,475, Feb. 26, 1946.

[9] Kroll W. J., Extractive Metallurgy of Beryllium: Bureau of Mines Inf. Circ. 7326, 1945, 15 pp.

[10] Williams, H. G., Heat-Treating Beryllium Copper for Peak Performance: Iron Age. vol. 156, No. 23, Dec. 6, 1945, pp. 58–64.

[11] Donachie, Matthew J., to Beryllium Corp., Method of Surface Hardening of Beryllium-Copper Alloys, and Articles Comprised Thereof: U. S. Patent 2,380,506, July 31, 1945.

[12] Kjellgren, Bengt R. E. (to Brush Beryllium Co.), Process for Producing Beryllium: U. S. Patent 2,381,291, Aug. 7, 1945.

Foreign review.—Until 1942 reported Australian beryl production had been negligible. Based on United States imports, production in 1943–45 was about 1,075 short tons, with most of the output in the first 2 years. The Metals Reserve Co. purchase price for the last 9 months of 1944 was $8.50 a short-ton unit, f. o. b. Australian ports. Most of the Australian beryl was mined in Western Australia in the Wodgina tantalite area and in the Gascoyne River area in the vicinity of Yinnietharra. At Wodgina over several years some 500 tons had been accumulated as a byproduct of tantalite mining.[13] The ore shipped averaged 12.06 percent BeO. The deposit was believed to be nearly exhausted by the end of 1944. Pegmatites at Yinnietharra carry some beryl, and a considerable quantity was picked up at weathered outcrops. A lot of over 38 tons assayed 13.19 percent BeO. Australian deposits have been described.[14]

The Deutsche Gold und Silber Scheideanstalt at Frankfurt a. Main, known as Degussa, since the mid-1930's has been the only producer of beryllium metal and oxide in Germany. In 1938 through September 1939 its reported output was only 500 kilograms beryllia and 700 kilograms metal. From October 1939 through 1944—the plant was not operative in 1945—output rose to 18.8 metric tons of oxide and 4.1 metric tons of metal. Total Axis output for the period was 20.6 metric tons Be content. Ore supply was originally from Brazil. During the war, additional ore was obtained from Scandinavia, Portugal, and Italian stocks.[15] During the war India reached second place in world beryl production, but at the conclusion of the Metals Reserve Co. foreign purchase program mining nearly stopped. It is believed that, at highest wartime prices ($9 a long-ton unit BeO) and with reasonably stable political and economic conditions, India's production might be maintained for several years at recent peak rates. Most of the output came from Rajputana. A description of the more important mines in the several States and production and other data were published.[16] The Government, as a part of its industrialization plan has displayed much interest in the country's beryl resources and is seemingly disposed to aid development of internal manufacture of beryllium oxide, metal, and alloys. An Italian firm, Societa Anonima Processi Privative Industriale ("Sappi") in 1936 constructed and operated a beryllium plant at Chivasso near Turin. From 1940 until the Germans were driven from Italy the plant was under their control and almost the entire output was shipped to Germany. It is claimed that a secret process used was superior to any other.

BORON

Production.—Shipments of ferroboron in 1945 were 109 tons with a boron content of 16 tons, compared with 112 tons and 15 tons respectively in 1944. In view of the improved availability of the common ferro-alloys, this may indicate that boron has attained a permanent position among steel addition agents. Shippers of ferroboron were the Electro Metallurgical Co., Molybdenum Corp. of

[13] Chemical Engineering and Mining Review (London), Beryl in Western Australia: Vol. 37, No. 438, Mar. 10, 1945, p. 194.
[14] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 4, Oct. 20, 1945, pp. 4–6.
[15] British Intelligence Objectives Subcommittee, Production of Beryllia and Beryllium at Degussa Plants: Final Rept. 158, Item 21, H. M. Stationery Office, London. A more detailed abstract will be found in Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 5, May 20, 1946, pp. 5–6.
[16] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 3, Mar. 20, 1946, pp. 4–9.

America, and Ohio Ferro-Alloys Corp. Special addition agents containing boron with other metals are made by the above-named manufacturers, as well as by the Titanium Alloy Manufacturing Co. and Vanadium Corp. of America.

Uses.—The most interesting use of boron was in the production of "atomic bomb" constituents. It has a strong tendency to absorb neutrons, and as the net number available for a self-sustaining uranium fission reaction is very small boron was not suitable as a "moderator"—that is, a mechanism for slowing neutron speeds to the range where they would be effective in disintegrating the U^{235} uranium isotope. How serious neutron loss was considered is indicated by the statement that high-purity graphite containing only about 2 parts per million of boron was undesirable as a moderator. However, the same characteristic makes boron useful in controlling the operating rate of the uranium-graphite piles used to produce the new element, plutonium. Boron as boron steel was so used. Boron trifluoride (BF_3) also was used in instruments employed for measuring neutron intensity in the piles.

The commercial use of boron in steel is essentially a wartime development. Although its use was proposed in a United States patent issued in 1924, acceptance of the proposal was slow, and in the United States the use of boron scarcely had passed the experimental stage as late as 1940 or 1941. The entrance of this country into the World War and the consequent shortage of basic steel-alloying elements greatly stimulated the use of boron, which reached a peak in 1943 at nearly eight times its 1940 consumption. The subsequent decline was in large part due to the drop in alloy-steel output and to the fact that boron's principal characteristic is to confer hardenability to steels of the medium carbon range.

In a recent review [17] on the use of boron in steel, it is reported that boron has a specific effect on hardenability that increases in proportion to total boron content to a maximum at 0.003 percent B and decreases with further additions. Although boron may displace as much as several hundred times its own weight of the commoner alloy elements it cannot eliminate their use, because there is a limit to the hardenability it affords and because the other elements furnish properties to steel that boron does not provide.

Prices.—Ferroboron, 17.5 percent minimum B, less than ton lots, was quoted at $1.30 a pound of alloy, unchanged throughout the year. F. W. Berk & Co. reduced its f. o. b. works price on 82- to 86-percent amorphous boron a pound to $15 on lots of 1 to 50 pounds, $13 on 50- to 100-pound lots, and $11 for 100- to 500-pound lots.

CALCIUM

From incomplete returns, calcium-metal production appears to have been much greater in 1945 than in the preceding year. War Production Board's calcium-metal Conservation Order M-303, with all authorizations and directions thereunder, was revoked May 2, 1945. The price for 97- to 98-percent metal was $1.85 a pound throughout the year. The principal producers of metal and hydrides were the Electro-Metallurgical Co., Metal Hydrides Co., and the New England Lime Co.

[17] Corbett, R. B., and William, A. J., Effects of Boron in Steel: Bureau of Mines Rept. of Investigations 3816; June 1945, 21 pp.

Calcium metal had been supplied by France and Germany up to 1939, and a small shipment was received in 1940, but there was no further movement until 1945, when 17,086 pounds were received from Canada. In 1945 Dominion Magnesium, Ltd., produced 29,543 pounds of calcium, the first commercial production in Canada. It was said to be exceptionally pure. The reported value, about 76 cents a pound, was less than half the quoted price in the United States.[18] In Germany during the war, production had been about 50 tons a month, of which about ¾ ton was converted to the hydride.[19]

Calcium metal and calcium-silicon imported for consumption in the United States, 1941–45 [1]

Commodity	1941		1942		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Calcium metal					17,086	$15,845
Calcium-silicon	111,994	$8,337	60,300	$10,144	164	22

[1] No transactions reported during 1943 and 1944.

Calcium has found increasing use as a deoxidizer in ferrous metallurgy and as an alloy constituent with nonferrous metals. It has been employed in the reduction of difficultly reducible metals, such as chromium, thorium, uranium, and zirconium. During the war an important calcium use was to make the hydride, which is a convenient and portable source of hydrogen for inflating weather balloons. Uranium metal had been made by reaction of calcium with the chloride or oxide and by reducing the oxide with calcium hydride; the latter was perhaps the first-applied (1941) relatively large scale production method. The uranium was, however, in the form of highly impure pyrophoric powder and was not usable in the atomic bomb project. However, by the end of 1942 acceptable metal was being turned out. Applications and uses of calcium have been reviewed and compiled in a textbook [20] that also discusses properties of the metal and production methods.

The usual methods of calcium-metal production are by electrolysis of the fused chloride or thermal reduction of the oxide, the first method having been commonly employed. In 1944 the New England Lime Co. developed, on a commercial scale, a process for calcium production by aluminothermic reduction of the oxide in vacuo.[21] The metal has an approximate composition of: Calcium, 98 to 99 percent, the principal impurities being magnesium 1.0 percent maximum and aluminum 0.2 percent maximum. The usual commercial grade is 96 to 98 percent calcium. High-purity metal may be extruded into various shapes.

COLUMBIUM AND TANTALUM

War Production Board General Preference Order M–296, Ferrocolumbium, was revoked July 9, 1945, but control of use was simul-

[18] Northern Miner, Calcium Produced by Dominion Mag.: Vol. 31, No. 47, Feb. 14, 1946, p. 17.
[19] Chemical and Engineering News, Developments in the German Chemical Industry: Vol. 23, No. 17, Sept. 10, 1945, p. 1519.
[20] Mantell, C. L., and Hardy, Charles, Calcium Metallurgy and Technology: Reinhold Publishing Co., New York, 1945, 145 pp.
[21] Staub, P. H., Calcium Produced by Ferrosilicon Process: Chem. and Met. Eng., vol. 52, No. 8, August 1945, pp. 94–96. The title is misleading, inasmuch as aluminum powder is used, not ferrosilicon, as in the Pidgeon process for magnesium production from dolomite.

taneously extended under Direction 5 of General Preference Order M–21, which was revoked August 21, 1945.

Domestic production.—Domestic production of columbium ore virtually ceased in 1945, but tantalum ore output declined only 24 percent. For the third consecutive year, Arthur Montgomery of Dixon, N. Mex., was the major producer; shipments of concentrate assayed 68 to 70 percent Ta_2O_5. Until mid-1945 the ore had been shipped to a customs concentrator. Thereafter a small concentrator using the Humphreys spiral was put into operation at the mine.[22] Recovery of microlite from the tantalum-lithium ore is 95 percent.

Columbium and tantalum ores shipped from mines in the United States, 1941–45

[Compiled by R. W. Metcalf]

Year	Columbium ore		Tantalum ore	
	Pounds	Value	Pounds	Value
1941			250	$219
1942			200	175
1943	5,771	$1,465	9,411	27,621
1944	3,208	917	7,204	23,317
1945	1,149	287	5,500	13,366

Foreign trade.—Imports of columbium ores reached a new high, about 15 percent above the previous record in 1944. Tantalite imports dropped off nearly one-fourth from the 1944 peak. Details of foreign trade are shown in the subjoined table. Exports in 1945 were: Tantalum, 11 pounds ($801) compared with 5,052 pounds ($77,463) in the preceding year; columbium ore, 5,000 pounds ($188) and metal, 1,334 pounds ($3,098). There were no exports of columbium ore or metal in 1944.

Columbium and tantalum ores imported for consumption in the United States, 1943–45, by countries, in pounds

Country	Columbium ore			Tantalum ore		
	1943	1944	1945	1943	1944	1945
Africa:						
British:						
Nigeria	2,350,329	3,658,084	4,220,691	5,757	18,116	31,410
Southern Rhodesia				40,481	12,794	9,967
Uganda [1]	3,111	23,603	33,381	3,063	7,277	11,348
Union of South Africa	4,325			1,332	632	2,027
Anglo-Egyptian Sudan					98	
Argentina	2,685			2,420	8,233	
Australia				10,708	9,315	21,125
Belgian Congo		1,373		157,073	332,312	485,986
Bolivia			1,034			
Brazil				416,874	440,460	68,229
Canada					700	
India and Dependencies	21,600	1,470		1,805	2,442	
Mozambique			22,046	3,567	4,751	
Total: Pounds	2,382,050	3,684,530	4,277,152	643,080	837,130	630,092
Value	$844,544	$1,196,899	$1,312,346	$724,066	$699,473	$453,141

[1] Classified by U. S. Department of Commerce as British East Africa.

Prices.—E&MJ Metal and Mineral Markets quoted $2–$3 a pound for 60-percent tantalite concentrate, depending on source. In the

[22] Wood, John A., Spiral Concentrator Recovers Tantalum Ores at the Harding Mine: Min. Cong. Jour., vol. 32, No. 1, January 1946, pp. 44–45.

United Kingdom the nominal price for columbite remained at about 60s. a unit combined Cb_2O_5 and Ta_2O_5 on 50- to 55-percent concentrate, based on 1942 freight rates, and for 60-percent Ta_2O_5 concentrate about £10 a unit, c. i. f. Domestic prices for metals and alloys, unchanged throughout the year, were: Tantalum metal, sheet at $143 and rod at $160.60 a kilogram; ferrocolumbium, 50 to 60 percent Cb at $2.25–$2.30 a pound contained Cb; and columbium metal, sheet at $500 and rod at $560.

Stocks.—At the end of 1945, the Office of Metals Reserve held 33,991 pounds of columbite and 1,095,862 pounds of tantalite containing 452,393 pounds of tantalum oxide (Ta_2O_5).

Uses.—The principal use of columbium is to inhibit intergranular corrosion in chrome-nickel steel by preventing formation of chromium carbide. It is also used in rods for welding stainless steels. Special strong, high-temperature-resistant steels of the stainless type containing columbium are being employed in gas turbines, turbosuperchargers, and jet-propulsion motors. Only minor uses have been found for columbium metal. A wartime-developed, extraordinarily sensitive, heat-detecting device, called a bolometer, has a columbium nitride surface. Tantalum metal was first used for electric lamp filaments but was soon superseded by tungsten. It is, however, much used in various types of electronic tubes. It is much more resistant than columbium to acid corrosion. Consequently it has had extensive use in acid-resistant apparatus and notably in hydrochloric acid production. Likewise, though quantitatively small, surgical uses have been important. During the war tantalum fluoride was widely used as a catalyst in butadiene manufacture. The carbides of both columbium and tantalum are extremely hard and have melting points of about 3,500° C. and 3,900° C. respectively. They have therefore been useful as cutting-tool inserts, wire-drawing dies, and various types of nozzles. Most applications have been in conjunction with ferrous metal.

Foreign review.—Argentine production of tantalite in 1944 was about 17,000 pounds, about one-half of which was sold. Western Australia has been an important source of high-grade tantalite, some of which carried nearly 80 percent Ta_2O_5. The principal area is in the vicinity of Wodgina. Production from this area to the end of 1944 had been about 250 tons valued at £A130,000. More than 12 tons had been recovered in the Greenbushes tin area in the southwest and a small quantity from the Coolgardie gold area. Reduction of ore at Wodgina is under consideration. The Belgian Congo has become the premier producer of tantalum-columbium ores. The output in 1944 was about 200 metric tons. Brazilian shipments in 1944, virtually all to the United States, were of the same order but declined sharply in 1945. Columbite and tantalite occurrences in eastern Bolivia were described.[23] In the Canadian Northwest Territories, in the Yellowknife district, production of columbite, tantalite, and beryl was expected to begin in 1945. Two small mills were to have been built. The Jantar Nigeria Co. increased its output of columbite from 327 tons in the year ended September 30, 1944, to 375 tons in the corresponding 1945 period. Reserves were said to be 3,582 tons. A new contract for 1946 is being negotiated with Ameri-

[23] Mineria Boliviano, Minas de Mica y Columbita en el Oriente Boliviano: Vol. 2, No. 17, April 1945, pp. 16–17.

can buyers.[24] Amalgamated Tin Mines of Nigeria recovered 1,421 tons of columbite from old tailings in the year ended March 31, 1945, and 414 tons in the period April–December 1945, compared with 125 tons in the previous year. It was expected that the dumps would be exhausted early in 1946. Thereafter only a small quantity will be available from current cassiterite operations. In 1944 Nigeria produced 2,072 tons of columbite, of which about one-half was derived from old tin-mining dumps. More than 6,000 tons were produced in the past 10 years.

GALLIUM AND GERMANIUM

Gallium and germanium remain in the very rare category, largely because few, if any, mineral concentrations could be worked profitably without the concurrent recovery of other metals and because few useful applications have been found. Gallium was first discovered (1875) in certain French zinc blendes and has been determined in many others. It is almost invariably associated with aluminum and with germanium has been found in the ash of some British coals. Germanite, the only mineral that contains an appreciable amount of gallium, about 0.8 percent, was found in the complex copper ores of Mansfeld, Germany. Gallium has a very low melting point, about 30° C., and remains liquid to between 900° and 1,000° C. Because of the low melting point, the metal may find use in the development of low-melting-point alloys. Its great range in the liquid phase gives it value as filling material in direct-reading high-temperature thermometers. The price of gallium was said to be about $3 a gram. Since 1943 the Anaconda Copper Mining Co. has produced several thousand grams of gallium in connection with its indium recovery.

Germanium is generally associated with zinc ores but usually in minute percentage. In the United States the Eagle-Picher Lead Co., Cincinnati, Ohio, continued production of metal and salts. Germanium is a byproduct from cadmium recovery. About 10 pounds of germanium may be recovered from 15,000 tons of ore. The present price is about $200 a pound compared with $4,500 5 years ago. The principal use has been in radionic devices. It gives high refractive values in optical glass, and alloys with magnesium, aluminum, gold, and platinum have desirable properties. The gold-germanium alloys have aroused considerable interest because of possible uses in jewelry and in dental inlays. A study of the alloy's characteristics was published.[25]

INDIUM

Domestic production.—In 1945 the byproduct recovery of indium was substantially lower than in 1944, and there was evidently much competition for markets in view of the large price drop. The indium content of metal, alloys, and salts shipped by producers in 1945 was 57,434 troy ounces. Earlier figures are not available for publication. In 1945 producers of metal and salts were the American Smelting & Refining Co., Anaconda Copper Mining Co., National Zinc Co., Inc., and the Sherwin-Williams Co. The Cerro de Pasco Copper Mining

[24] Metal Bulletin (London), Jantar's Output: No. 3057, Jan. 1, 1946, p. 16.
[25] Jaffee, Robert I., Smith, Eugene M., and Gonser, Bruce W., The Constitution of the Gold-Germanium System: Am. Inst. Min. and Met. Eng., Metals Technol., vol. 12, No. 4, June 1945, Tech. Paper 1812, 7 pp.

Co. has carried out research on the recovery of indium from lead-refining drosses.[26]

Prices.—The year's opening price of $7.50 a troy ounce (99.9 percent indium) dropped to about $4 in March. Late in June metal was readily purchasable at $3 and in September dropped further to $2.25, with an indication that a discount might be made on bulk purchases. In less than 2 years the price cut was more than 75 percent; 10 years earlier the price had been 13 times the figure at the end of 1945.

Uses.—The major use has been in heavy-duty composite metal bearings employed extensively in airplanes, tanks, and other mobile equipment. A zinc-indium alloy was used in applying a noncorrosive plating to hollow-steel airplane propellers. Minor uses have been in solder and brazing alloys and alloyed with gold and silver for jewelry and plated articles. The first commercial use about 1927 was as a nontarnish coating on silverware. Low-melting-point alloys also have been manufactured recently. Indium foil was used as neutron indicator in the atomic bomb project uranium-graphite piles. Low-energy neutrons—about 1.5 electron-volt—are particularly effective in inducing artificial radioactivity in indium.

SELENIUM AND TELLURIUM

Domestic production.—Production of elemental selenium increased 12 percent above the 1944 level; producers' shipments rose nearly 50 percent and were about 2 percent below the record figure of 1941. Both tellurium production and sales increased substantially compared with 1944 and were approximately three-quarters and one-third, respectively, above the 1936–40 averages. At the same time the output ran ahead of market needs, resulting in a 12-percent increase in producers' stocks. On the other hand, selenium producers' stocks declined 24 percent.

Salient statistics of elemental selenium and tellurium in the United States, 1941–45

Year	Selenium					Tellurium [1]		
	Production (pounds)	Producers' sales [2] (pounds)	Producers' stocks at end of year (pounds)	Imports [3]		Production (pounds)	Producers' sales [2] (pounds)	Producers stocks at end of year (pounds)
				Pounds	Value			
1941	620,493	681,650	146,000	197,873	$288,161	224,639	239,983	20,400
1942	506,426	316,613	341,900	83,666	127,004	224,132	98,798	145,700
1943	635,581	521,779	455,677	81,720	142,032	56,174	62,260	139,403
1944	485,446	423,906	517,217	97,800	170,582	69,025	45,323	163,105
1945	542,099	666,363	392,953	219,215	395,934	80,750	60,328	183,527

[1] Includes tellurium content of small quantity of oxide.
[2] Bureau of Mines not at liberty to publish value. Quantities for 1942–45 represent producers' shipments.
[3] Includes selenium salts.

Foreign trade.—Selenium imports, all from Canada, reached a record height at nearly 11 percent above the 1941 figure. Tellurium imports are not recorded separately. Exports of selenium, including selenium content of compounds, and tellurium in 1945, as reported by domestic producers, were 22,965 pounds and 267 pounds in comparison with 13,191 pounds and 288 pounds, respectively, in 1944. As far as known, the 1945 figures are the highest on record.

[26] Wright, T. R., The Cerro de Pasco Enterprise, Metallurgical Research: Min. and Met., vol. 26, No. 467, November 1945, pp. 559–560.

Prices.—As reported by E&MJ Metal and Mineral Markets, prices of selenium (black, powdered, 99.5 percent) and of tellurium were $1.75 a pound, nominal and unchanged in 1945. The selenium price has remained constant for at least 8 years, and tellurium changed from $2 in 1938 to $1.75 in 1939 and has been unchanged since. In London tellurium was quoted at 7s. a pound and selenium at 8s. 6d., with consistent demand.

Uses.—Important uses for selenium are in rubber compounding; as a decolorizer in glassmaking, or as a colorant for pink and with cadmium and sulfur for ruby glasses; in stainless steels to improve machinability; in alternating current rectifiers; in nonferrous alloys, especially with copper; in pigments; and as an antioxidant in lubricating oils. The use in rectifiers is growing rapidly because of their high efficiency (even at high ambient temperatures), long life, stability, and virtual absence of maintenance cost. Rectifiers are widely used in aircraft and for numerous electronic devices, battery charging, electroplating, and welding. The use of tellurium has not grown rapidly. Principally it is employed in vulcanizing rubber, to which it imparts toughness and abrasion resistance not given by sulfur; as an alloying agent with nonferrous metals, particularly lead, to which it adds corrosion resistance, fine grain, and mechanical strength; and in copper-base alloys to improve machinability and corrosion resistance. Extremely small additions to cast iron increase chill depth and hardness. The identification of selenium (atomic number 34) and tellurium isotope (atomic number 52) fragments resulting from neutron bombardment of uranium aided in establishing the certainty that the uranium nucleus could be split into roughly equal parts.

Foreign production.—Preliminary estimates of selenium and tellurium output in Canada in 1945 were, respectively, 419,000 and 42,000 pounds. Final figures for 1944 were, respectively, 298,592 and 10,661 pounds.

THALLIUM

Domestic production of thallium in 1945 declined somewhat compared with 1944. Although demand was very strong in the first half year because of rodenticide needs of the military services, the termination of hostilities in midsummer, coupled with the importation of 1,000 kilograms from France and 500 kilograms from Belgium greatly changed the supply-demand balance. The American Smelting & Refining Co., as heretofore, remained the only domestic producer. In Belgium and in France producers are Société de la Vieille Montagne and Alais Froges et Camargue, respectively. In Germany the shortage of thallium became acute because internal production was small and Algeria, the source of red squill of the best quality and in the largest volume, was cut off. Organic synthetics were substituted but were not as effective as the thallium. The Fish and Wildlife Service of the Interior Department announced the development of the most potent rodenticide yet known, "1080" or sodium fluoroacetate. Because of its extreme toxicity—an antidote has not yet been found—to man and animals other than rodents the sale to the public of this exceptional poison is currently barred. The Fish and Wildlife Service had estimated national requirements of thallium for the fiscal year ending June 30, 1947, to be about 7,500 pounds; however, as a result of the highly satisfactory field tests with "1080," thallium requirements are likely to be less than the above estimate. Another powerful thallium sulfate substitute, "Antu" or alpha-naphthyl thiourea, was reported by the Federal Public Health Service.[27] This poison is said not to be dangerous to human beings nor to many animals and though toxic to the so-called Norway rat it has apparently little effect on the black or Alexandrine rat. These two rodent poisons were listed by Science Service as eighth among the 10 most important scientific developments of 1945. E&MJ Metal and Mineral Markets reported thallium at $12.50 a pound, unchanged throughout the year.

Thallium has had little use other than as a rodenticide or insecticide. Lead-thallium alloys are said to be very highly resistant to corrosion, and use in bearing metals was early proposed. Patents on copper-thallium, copper-lead-thallium, and silver-thallium bearing metals were issued in 1945. Characteristics and certain applications of the last-named were described.[28]

URANIUM AND DERIVATIVES

General.—From the discovery of radium in uranium ore in 1898 up to about 1940 the demand for uranium was essentially a direct function of the use of radium. The several million times greater volume of residual uranium products thus became of secondary importance. In fact, in the immediate prewar years the expanding use of radium tended to create a surplus of uranium products. No exact measure of the demand for either metal is available. However, in 1939 the two outstanding producing companies agreed to share the world market because their output potential exceeded absorption capacity, without a major price reduction. About that time, radium sales were of the order of 100 grams, equivalent to something less than 500 short tons of uranium oxide (U_3O_8) yearly, and plant capacity was possibly more than double that. For at least a few years in the period 1940–45, that capacity, or the corresponding mine output, was utilized, and in addition there was a substantial domestic uranium output. The reason for the tremendous stimulation in demand is now known.

Henceforth, radium is likely to have a subordinate position because of the coming availability of a great array of uranium fission products and others that can furnish a large range of types and intensities of radiation. Not only will uranium supply these products as well as artificially radioactive materials but contemporaneously will furnish tremendous quantities of thermal energy that may prove competitive with present sources of power. The nearby needs for uranium in this country, assuming peaceful uses only, will not be large, because past uses will be considered wasteful in the light of the vastly greater economic value of the new products, as well as the enormously favorable ratio of conversion of the raw material to them. Further, in the utilization of uranium for atomic bombs, there remained considerable quantities of useful radioactive materials.

Domestic production.—A short historical survey of uranium-bearing ore production was given in the 1944 chapter of this series. It was

[27] Science News Letter, Can Kill 300,000 Rats: Vol. 48, No. 14, Oct. 6, 1945, pp. 211–212.
[28] Hensel, Franz R., Silver-Thallium Antifrication Alloys: Am. Inst. Min. and Met. Eng., Metals Technol., vol. 12, No. 7, October 1945, Tech. Pub. 1930, 14 pp.

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indicated therein that little uranium was available from pre-1936 vanadium-ore production. From 1937 to 1940 the expanding needs for steel-alloying elements greatly stimulated domestic vanadium-ore production. Although the total ore shipments were several hundred thousand tons, the demand for uranium was so small that only about 13,000 tons were classified as uranium ores. The average uranium content reported was less than 12 pounds a ton. Up to this time, the uranium recovered was mostly used in the ceramic field. From 1941 on data are not fully available. It has been reported that two or more uranium-recovery plants were erected in 1940 and later in Colorado. These plants treated accumulated tailings from the vanadium operations amounting to a few hundred thousand tons as well as the waste from current vanadium operations. The grade of material was probably much lower than that indicated for 1937–40, which included material chosen for its high uranium content. From 1940 on both Canada and the Belgian Congo supplied large quantities of materials, principally uranium oxide and concentrates. The total availability of uranium was therefore substantial. World production up to 1939 appears to have been of the order of 6,500 tons (U content) or 13,000,000 pounds. Inasmuch as vanadium-ore output dropped sharply after 1943 treatment plants became inactive and a Government uranium plant at Grand Junction, Colo., was dismantled, current output will be small.

Uranium metal first was made about a century ago, but it was so little known up to about 1940 that even some of its physical properties, for example, melting point, were not known with precision. For the various needs of the atomic bomb project, a large quantity of materials of extremely high purity were known to be required, but even up to the end of 1941 only a few grams of usable material were available. The difficult technical problems of large-scale output were solved in 1942, and by the end of that year production apparently attained the rate of about 1 ton a day in metal. This rate was increased and seems to have been continued well into 1945.

Data on domestic production of radium from available domestic and foreign ores are not yet available, but output is understood to have been negligible. The last reported production was 2.6 grams in 1942. Imports of radium salts in 1942–45 correspond closely to the quantities reported in preceding chapters of this series to have been put into use.

The quantities of the fissionable isotope U^{235} and of plutonium made remain a secret. The critical size for the bombs was said to lie between 2 and 100 kilograms. Both U^{235} and plutonium were used in the bombs. Four or more have been prepared, and separation plants continued in operation into 1946. Nevertheless, it is evident that several hundred kilograms may have been prepared. From the practical standpoint, production of the new element plutonium, which was begun on large scale at Hanford, Wash., in September 1944, though an intricate and difficult problem is more efficient than the uranium-isotope separation. As far as known, the plutonium production piles were still in operation when this section was being prepared (May 1946).

Byproducts production.—As yet no information is available on the quantity or exact nature of byproducts arising from the chain-reacting piles designed for plutonium manufacture. Since the sole object was to produce plutonium rapidly complete separation of the various auxiliary products does not yet appear to have been undertaken. Some 150 isotopes of about 35 elements in the atomic mass ranges 83 to 115 and 127 to 154 were created in the U^{235} Pu^{239} fission. Among them were elements 43 and 61 (masurium and illinium), whose earlier isolation has been questioned. Of these, according to the Smyth report, about 20 are in significant concentration, with the most abundant less than 10 percent of the aggregate. The half-lives (the period in which one-half disintegrates) of these intermediates range from a small fraction of a second to a year or more and for several of the more important a month or so. Some are gaseous and are wasted into the atmosphere. Others are retained in the affluents from the units in which the plutonium is extracted from the reacted uranium slugs and are held in storage basins. Presumably, a substantial quantity of relatively long-lived radioactive products will have been accumulated.

The discovery or development of two new elements of atomic numbers 95 and 96, for which the names americium and curium have been proposed, was announced by Seaborg.[29] Like neptunium and plutonium, they are radioactive. These new elements have not been found in nature, nor until 1942 had any evidence of the natural existence of neptunium and plutonium been discovered. With the knowledge of the characteristics of these elements, a careful search revealed certain alpha activity in pitchblende that corresponded to about 1 part plutonium in 10^{14} in the pitchblende.

Foreign trade.—In 1945 imports, compared with those of 1944, dropped 33 percent for radium and 5 percent in radio-active substitutes; those of uranium oxide and salts were negligible. Virtually all imports came from Canada. In 1944 exports were: Uranium salts and compounds, 100,154 grams ($1,064); radium salts and compounds, 2,600 milligrams radium content ($58,339); radium medicinal salts and compounds, 2,152 milligrams radium content ($61,747). In 1945 they comprised: Uranium salts and compounds, 68,000 grams ($993); radium, 361 milligrams radium content ($5,414); radium salts and compounds, 2,526 milligrams radium content ($49,397); and radium medicinal salts and compounds, 8,249 milligrams radium content ($180,235).

Radium salts, radioactive substitutes, and uranium ore and compounds imported for consumption in the United States, 1941–45

Year	Radium salts			Radio-active substi-tutes [1] (value)	Uranium ore		Uranium oxide and salts	
	Grams	Value						
		Total	Average per gram		Pounds	Value	Pounds	Value
1941	4.412	$110,202	$25,000	$13			387,505	$501,370
1942	23.043	377,326	16,400	50	541,307	$806,919	377,398	851,098
1943	90.755	1,366,538	15,100	35,589			211,348	413,410
1944	101.290	1,374,933	13,600	128,010			10,425	11,074
1945	67.342	991,979	14,730	122,178			1,080	2,244

[1] Principally mesothorium.

[29] Chemical and Engineering News, Discovery of Elements 95 and 96 Announced at Chicago A. C. S. Conference: Vol. 23, No. 22, Nov. 25, 1945, p. 2085.

Prices.—Quoted price for radium in salts continued in 1945 at $25 to $30 a milligram. Based on export valuation, prices received ranged from about $15 to $22 a milligram radium content. The Oil, Paint and Drug Reporter quoted black uranium oxide at $2.55 a pound and orange salt (sodium uranate) at $1.65 a pound, both unchanged throughout the year. Prices of other materials or products are not available. According to the Smyth report, highly purified uranium metal at first cost about $1,000 a pound; this was later reduced to about $22.

Uses.—The common nonmilitary uses have been as a ceramic colorant, in photographic chemicals, and as catalysts. From the late twenties up to World War II, except for a few years in the early thirties, consumption rarely was under 200,000 pounds (oxides and salts) and in a few years was virtually double that quantity. Control of use of uraniferous materials was made effective under WPB Conservation Order M–285 in January 1943 and is still in effect. The stringent contraction in nonmilitary use of uranium salts is shown in the accompanying table in pounds of U_3O_8.

	1943	1944	1945
Chemical and photographic	4,000	6,700	3,800
Electrical	250	800	1,000
Ceramic	7,500	100	150
Total	11,750	7,600	4,950

In recent years the use of radium in medicine has been overshadowed by its industrial use for radiography and during the war by consumption in luminous paints. From incomplete data for 1945 it is estimated that consumption for the last-named was about 23 grams compared with 50 grams in 1944 and 75 grams in 1943. Industrial and medical radiographic use was estimated to have become about 50 grams compared with about 36 grams in 1944. The National Bureau of Standards tested 2,353 preparations containing 65,937 milligrams of radium or roughly 20 percent less than in the preceding year. The special use of radium and beryllium as a source of neutrons in pilot-scale reaction piles was mentioned in the Beryllium section of this chapter.

Elsewhere it has been pointed out that, in addition to the explosive products, numerous byproducts arise. It is not improbable that subcritical quantities of U^{235} and plutonium may have important research if not industrial value. On the other hand, as a matter of international safety, it is proposed that an international control authority would not permit use outside its own laboratories of other than "denatured" materials; hence, it is from the several byproduct classes that mankind soon may benefit. In broad terms, these are thermal energy and direct radioactive products or isotopes that may be made by introducing foreign materials into reaction piles.

The heat output is enormous, but there are now many unsolved problems connected with its utilization. It is not to be expected that it soon could compete economically with the common fuels, and in the nearer future it could be developed only in massive plants because of the heavy radiation shielding required. It has been suggested that in remote desert, arctic, or other undeveloped regions such plants might attain earlier importance. The time for such development has been estimated to range from about 1 to 20 years or more. The cyclotron has been the source of many products of the other classes. Even the greatest of these machines has a minute output capacity, with very high power input. A vastly greater supply is already existent in the uranium fission plants. Enough of these virtually new products is known to indicate that the science of metals stands at a new threshold, with these materials as tools. Likewise in chemistry, biology, and therapy new vistas are opened; even the secret of photosynthesis may be unraveled. Already steps have been taken to expedite peaceful applications. Gen. Groves announced in April 1946 that the Monsanto Chemical Co. would supervise design, construction, and operation of a plant planned solely as an atomic power plant. It was stated further that other important organizations, among them the Allis-Chalmers Manufacturing Co., the General Electric Co., and the Westinghouse Electric Corp., which had so largely participated in the atomic bomb project, will likewise manage broad-scale research for or in conjunction with the Government.

Technology.—Up to about 1942 pure uranium had not been made. Details of the methods later developed have not been disclosed. Earlier schemes were reduction of uranium chloride by calcium and direct oxide reduction with calcium or calcium hydride. The last-named methods produced pyrophoric and very reactive powders of about 99.8 percent purity. Highly pure metal had been made by fluoride (KUF_5) electrolysis, but as it depended on sunlight for a photochemical reaction the method was not suited to volume production. The National Bureau of Standards then perfected an ether extraction method for treating uranyl nitrate that furnished a satisfactory, pure, brown, uranium dioxide (UO_2). This oxide was used as a base for the potassium uranium pentafluoride and the uranium hexafluoride used for isotope separation and also as a metal source. Since U^{235} is chemically identical with the major isotope U^{238}, recovery methods were physical in nature. The principal ones employed were gaseous diffusion through porous barriers, thermal diffusion, and electromagnetic separation in cyclotrons. A centrifuging process also was used but did not go beyond pilot-scale operation. The first pure chemical compound of plutonium was prepared in August 1942. This new metal results from neutron capture by U^{238} becoming the isotope U^{239}, which rapidly decays with two successive beta-particle (electron) transformations to become neptunium (Np^{239}) and then plutonium (Pu^{239}). Plutonium is an alpha particle (helium nucleus) emitter and eventually becomes U^{235}. The decay rate is, however, so low that it may be considered a stable element, but like U^{235} is readily fissionable. Separation of plutonium from uranium apparently was carried out by coprecipitation with a carrier, analogous to precipitation of radium with barium, as in the radium-uranium separation, followed by successive dissolutions of the precipitate and reprecipitations until unwanted fission products were reduced to a satisfactory level. This involved about 30 major chemical reactions and hundreds of operations, all remotely controlled because of the intense radiation. Final purification, melting, casting, and forming were conducted at the New Mexico laboratories.

Foreign notes.—As in the United States, virtually all countries that possess radioactive minerals have established controls over movements of such materials or have nationalized the deposits. In the United States, including Alaska, all public lands that contain deposits of radioactive minerals were withdrawn by Executive Order 9613, September 13, 1945.

Australia.—It was claimed that one of the world's largest uranium deposits was discovered near Stanthorpe, Queensland. The ore was said to carry up to 3 percent uranium. A small output had been obtained some years ago from the vicinity of Mount Painter and Radium Hill in South Australia. Strong efforts were made in 1944 to revive production but without notable success. Ore is low-grade and very difficult to treat.

Canada.—Field exploration was most active, especially in the Northwest Territories, in 1943-45 and is to be continued in 1946. Several strong, radioactive areas were said to have been found. Interest was revived in the Goldfields Lake, Athabaska, area from which small pitchblende shipments had been made before the war. The International Uranium Mining Co., Ltd., Great Bear Lake area, expects to reopen its mine in 1946. There has been small and intermittent production from Haliburton County, Ontario. The Canada Radium Mines plans to start milling operations there in 1946. The Canadian Government began laboratory work on uranium fission in 1942 and subsequently erected an experimental plant at Petawawa, Ontario, on the Ottawa River. A reaction pile using heavy water as a moderator is in use. Investigations on the use of thorium are also under way. Research results were exchanged with British and American project scientists. A number of workers on the Canadian project were arrested and later convicted for having divulged various secrets to a foreign power. The Eldorado mine, Great Bear Lake, and the treatment plant at Port Hope, Ontario worked at capacity.

Czechoslovakia.—The State-owned mines at Jachymov were reported to be working normally after the withdrawal of Russian troops. The Nation's Business of April 1946 states, however, that the operation was supervised by Russian troops. The German Economic Ministry reported pitchblende-concentrate production in the Sudetenland for 1939–42 to have been in metric tons: 11.5, 12, 11, and 19. The corresponding uranium oxide (U_3O_8) figures were 5.7, 5.9, 5.5, and 9.5. In 1941 radium production was 1,826 milligrams and in 1942, 2,662 milligrams. These figures are of the same order as those usual in the prewar period.

Germany.—It was known that Germany was undertaking atomic bomb development. Scant information indicates that a shortage of scientists greatly retarded development. Large quantities of heavy water were ordered, and the producing plant at Rjukan, Norway, was enlarged. The plant and accumulated stock were successfully destroyed by British and Norwegian raiders. As a part of the industrial disarmament program for Germany, the production of radioactive materials (as well as of beryllium) has been prohibited.

U. S. S. R.—Geologists are continuing to search the Urals for radioactive minerals. Uranium ores were reported to have been discovered in the central Asia's Tadzhik S. S. R. According to the Mining Journal (London),[30] a huge deposit of highly radioactive vanadium ore has been discovered at Jabagai, Kazakstan.

[30] Undasynow, N., The Metals of Kazakstan: Min. Jour. (London), vol. 225, No. 5753, Nov. 24, 1945, p. 802.

ZIRCONIUM

[Prepared by Allan F. Matthews]

Domestic production.—Zircon output reached several thousand tons in 1945 compared with several hundred annually in 1940–44 but was still less than the 3,646 short tons produced in 1927. The principal producer was Humphreys Gold Corp., which began recovery of zircon August 1945 as an accessory of titanium minerals from beach sands near South Jacksonville, Fla., and which was operating the property for its owner, Rutile Mining Co. of Fla. (subsidiary of Titanium Alloy Manufacturing Co.). The only other domestic producer was Riz Mineral Co., which mined black sands near Vero Beach, Indian River County, Fla., and recovered zircon, rutile, and ilmenite in its concentrator at Melbourne, Brevard County, Fla.

Foreign trade.—Imports of zircon reached a new high in 1945, but those of baddeleyite continued to decline. Exports in 1945 comprised 108 short tons ($7,126) of zirconium concentrates, 30 tons ($15,383) of metal and alloys, 203 tons ($95,792) of oxide, and 253 tons ($36,384) of other zirconium compounds.

Zirconium concentrates imported for consumption in the United States, 1941–45, by countries, in short tons [1]

Year	Zircon from—				Baddeleyite from Brazil	Accessory titanium minerals [3]	Total zirconium concentrates [4]	
	Australia	Brazil	Other [2]	Total			Short tons	Value
1941	14,689	(5)	963	15,652	[5] 5,002	7,020	27,674	$604,744
1942	11,145	----------	196	11,341	15,283	7,282	33,906	816,364
1943	11,472	110	----------	11,582	8,821	8,009	28,412	697,704
1944	11,317	(5)	----------	11,317	[5] 2,332	10,384	24,033	576,299
1945	17,138	(5)	6	17,144	[5] 792	8,534	26,470	554,400

1 Totals and country break-down by the U. S. Department of Commerce. Mineral break-down by Bureau of Mines.
2 From India, 1941–42; French West Africa (Senegal), 1945.
3 Rutile and ilmenite content of mixed zirconium-titanium concentrates imported from Australia.
4 Classified as "ore" by U. S. Department of Commerce.
5 Any zircon imports from Brazil, 1941 and 1944–45, included with baddeleyite. The 101 tons of zirconium concentrates from Brazil, shown as zircon in Minerals Yearbook, 1944, was actually baddeleyite.

Consumption and uses.—Zircon shipments to consumers reached a record level of 15,988 short tons in 1945 compared with 14,484 tons in 1944. Use distribution in 1945, according to estimates by principal shippers, was as follows, in percentages: Electrical and chemical porcelains, 34; metal and alloys, 17; refractories, 17; pottery glazes and vitreous enamels, 12 each; glass, 7; and miscellaneous, 1. The occurrence, properties, and major applications of zircon were described.[31] Baddeleyite is consumed primarily for refractories and alloys. A new producer of zirconium-copper and oxide is Beryllium Corp., Reading, Pa. The Bureau of Mines began production of ductile zirconium on a laboratory scale November 1945. The metallurgy of zirconium was reviewed.[32]

31 Thielke, N. R., and Jamison, H. W., Development of Zircon as a Versatile Ceramic Material: Bull. Am. Ceram. Soc., vol. 24, No. 12, Dec. 15, 1945, pp. 452–456.
32 Kroll, W. J., and Schlechten, A. W., Survey of Literature on the Metallurgy of Zirconium: Bureau of Mines Inf. Circ. 7341, 1946, 50 pp.

Stocks.—Producers' and distributors' stocks of zircon (including zircon content of zirconium-titanium concentrates) were 6,316 short tons at the end of 1945 compared with 4,867 (revised) in 1944. Government-owned Office of Metals Reserve stocks were 2,581 tons of zircon and 15,829 tons of baddeleyite at the end of 1945, compared with 4,840 and 15,848 tons, respectively, at the end of 1944.

Prices.—Zirconium ore, 55 percent ZrO_2, f. o. b. Atlantic seaboard, was quoted nominally at \$65–\$75 a short ton in January to November 1945 and \$60–\$70 in December, according to E&MJ Metal and Mineral Markets. Zirconium ferro-silicon was quoted throughout the year at \$102.50–\$107.50 a long ton for 12- to 15-percent Zr content and 14–16 cents a pound for 30- to 40-percent Zr and powdered zirconium metal at \$7 a pound.

Foreign production.—Most of the world's production of zircon is from Australia, which in 1944 produced 15,680 short tons (contained in zirconium-titanium concentrates) and exported 14,156 tons.[33] Brazil exported 2,372 short tons of zirconium concentrates (almost exclusively baddeleyite) in 1944 compared with 5,424 tons in 1943 and 18,865 tons in 1942. No zircon was produced in India in 1943, but output averaged 1,600 short tons annually in 1933–42.[34]

[33] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 1, January 1946, pp 21–23.
[34] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 2, February 1946, pp. 21–25.

PART III. NONMETALS

BITUMINOUS COAL AND LIGNITE [1]

By W. H. Young, R. L. Anderson, and L. H. Isaac

SUMMARY OUTLINE

SURVEY OF THE BITUMINOUS-COAL AND LIGNITE INDUSTRY IN 1945

The production of soft coal in 1945—an estimated output of 576,000,000 net tons [2]—declined 7 percent from the previous all-time high of 619,576,240 tons in 1944. Although the war was over, the shortage of coal continued, and Government controls were retained. Labor difficulties caused several interruptions to production. According to the Bureau of Labor Statistics, there were 598 strikes in soft-coal mines in 1945, with 581,000 workers involved, 5,007,000 man-days lost (an average of 8.6 days per man), and an estimated loss in production of 30,000,000 tons. Difficulty in obtaining supplies and machinery and a shortage of men also caused a loss in output.

Production.—There was practically no seasonal decline in production in 1945, due largely to the Government program urging consumers to accumulate stocks during the summer. Throughout most of the year production was over 11,000,000 tons per week, except when output was reduced because of strikes or holidays.

Consumption.—All of the major classes of consumers used less coal in 1945 than in 1944 with the exception of cement mills and bunkers in foreign trade. The total consumption in 1945 was approximately 32,000,000 tons less than in 1944. Table 5 shows the trends in consumption for the major classes of consumers.

[1] Data for 1945 are preliminary; detailed statistics with final revisions will be released later. Data for 1944 are final.

[2] Throughout this chapter, "tons" refers to net tons of 2,000 pounds, unless otherwise indicated.

Changes in stocks.—The reserve supply of bituminous coal and lignite in the hands of industrial consumers and retail coal yards decreased from 57,204,000 tons at the beginning of 1945 to 45,665,000 tons at the close. The days' supply of stocks decreased from 32 to 27. Stocks on the upper Lake docks decreased 1,110,206 tons from January 1 to December 31, 1945.

Distribution.—Shipments of bituminous coal and lignite during 1945 showed decreases in most of the channels of distribution compared with 1944. Table 10 shows trends in distribution of bituminous coal and lignite for 1939–45. Changes in the monthly volume of the more important movements are shown in figure 9.

Mechanization.—The quantity of coal loaded mechanically at underground mines in the United States continued to advance during 1945. Mechanical loading increased from 53 percent of the total underground output in 1944 to an estimated 56 percent in 1945. Sales of underground loading equipment, in terms of capacity, were 25 percent greater than in 1944.

Mechanical cleaning.—The total capacity of mechanical-cleaning equipment sold for use at bituminous-coal mines in 1945 was estimated at 10,100 tons of cleaned coal per hour, an increase of 87 percent from the previous year.

Trend of employment.—An estimate of the average number of men employed at bituminous-coal and lignite mines in 1945 indicates a drop to 370,000 men from 393,347 in 1944.

Index to capacity.—The potential output upon a 308-day basis (6-day week, full-time capacity) was 686,000,000 tons in 1944. Since it is not possible for all mines to operate 308 days per year, a more conservative figure of 280 days was suggested some years ago by the coal committee of the American Institute of Mining and Metallurgical Engineers (see Minerals Yearbook, 1935, pp. 631–632). The average output per day worked in 1944 was 2,228,691 tons, which (if applied to 280 days) gives an annual potential output of 624,000,000 tons compared with the actual total production of 619,576,240 tons. For purposes of historical comparison, a capacity of 261 days, based on the 5-day week, is also shown in figure 4 and tables 12 and 13.

Trend of fuel efficiency.—For many years prior to 1942 there was a steady trend toward increased fuel efficiency. During the period 1942–45 this trend was arrested or reversed. All industries shown in table 6 exhibited decreased fuel efficiency in 1945 compared to 1944 except electric public-utility power plants, which registered no change.

Competition of oil and gas.—Shortly after the close of the war increased competition between the fuels developed, with numerous reports of conversion from coal to fuel oil.

Electric power utilities consumed 9 percent less bituminous coal, 3 percent less fuel oil, and 9 percent less gas in 1945 than in 1944.

Class I railroads decreased their consumption of coal 5 percent in 1945, and their purchases of fuel oil were decreased from 1944 purchases by 1 percent.

The manufacture of domestic coal-burning equipment is reflected in statistics published by the Bureau of the Census. Factory sales of domestic stokers for burning bituminous coal increased from 1,714 in 1944 to 89,522 in 1945. Shipments of domestic oil burners, boiler-burner units, and furnace-burner units increased from 45,752 in 1944 to 139,611 in 1945.

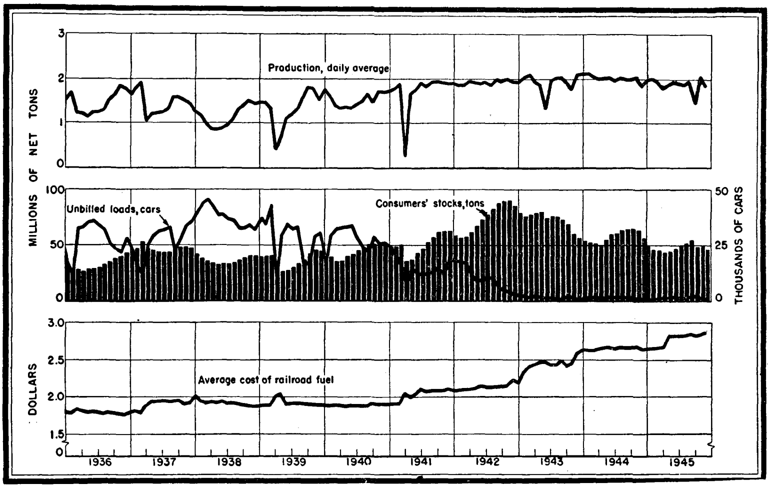

FIGURE 1.—Trends of production, stocks, and prices of bituminous coal and lignite in the United States 1936–45.

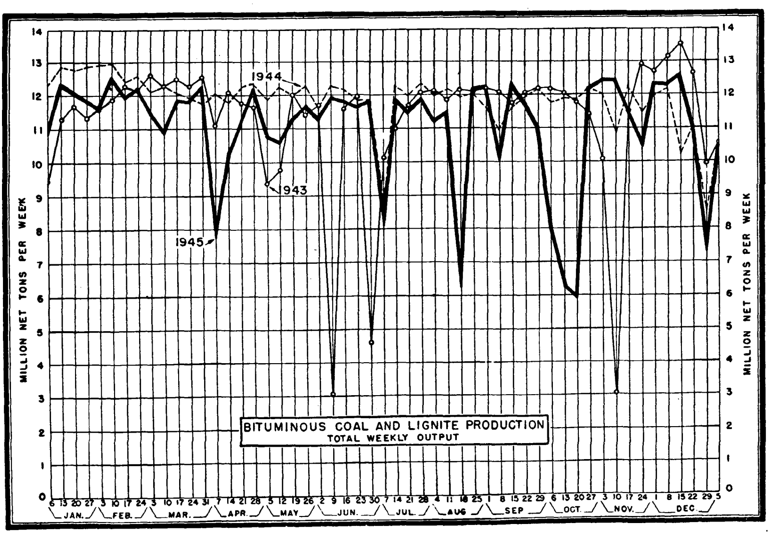

FIGURE 2.—Production of bituminous coal and lignite in the United States, by weeks, 1943–45.

SOURCES OF DATA

Bituminous-coal and lignite production statistics for 1945 are preliminary estimates based upon (1) weekly or monthly reports of railroad carloadings of coal and beehive coke by all the important carriers, (2) shipments by river as reported by the United States Army Engineers, (3) direct reports from a number of mining companies, and (4) monthly production statements compiled by a number of local operators' associations and State mine departments. In the estimates for 1945, allowance has been made for commercial truck shipments, local sales and colliery fuel, and small trucking or wagon mines producing over 1,000 tons a year.

Data for 1944 are final and are based upon detailed annual reports of production and mine operation furnished by the producers. As in previous years, all but a small percentage of the output was covered by the reports submitted. For the remaining output not directly reported—consisting chiefly of small mines—it has been possible to obtain reasonably accurate data from the records of the State mine departments, which have statutory authority to require such reports, or, in a few instances, from railroad carloadings.

Final figures of employment obtained from the annual canvass of production as shown in this report for 1944 differ slightly from the estimated total of employment based on the monthly canvass of accidents at mines accounting for approximately 70 percent of the total bituminous-coal output, as published in the chapter from Minerals Yearbook 1944 entitled "Employment and Accidents in the Mineral Industries." According to the annual canvass, the average number of men employed amounted to 393,347, whereas the monthly canvass indicated that the total average number working was 380,000. The major cause for this slight discrepancy was that the figure determined by the annual canvass represented the average number of men on the rolls per pay period while the other represented the average of men working daily.

In accordance with the practice followed by the Bureau of Mines in previous years, the statistics in this report relate to mines having an output of 1,000 tons a year or more and do not attempt to include many small mines producing less than 1,000 tons a year that sell their output by wagon or truck.

These data include, for convenience and historical comparison, the small output of anthracite and semianthracite produced outside Pennsylvania and the production of lignite.

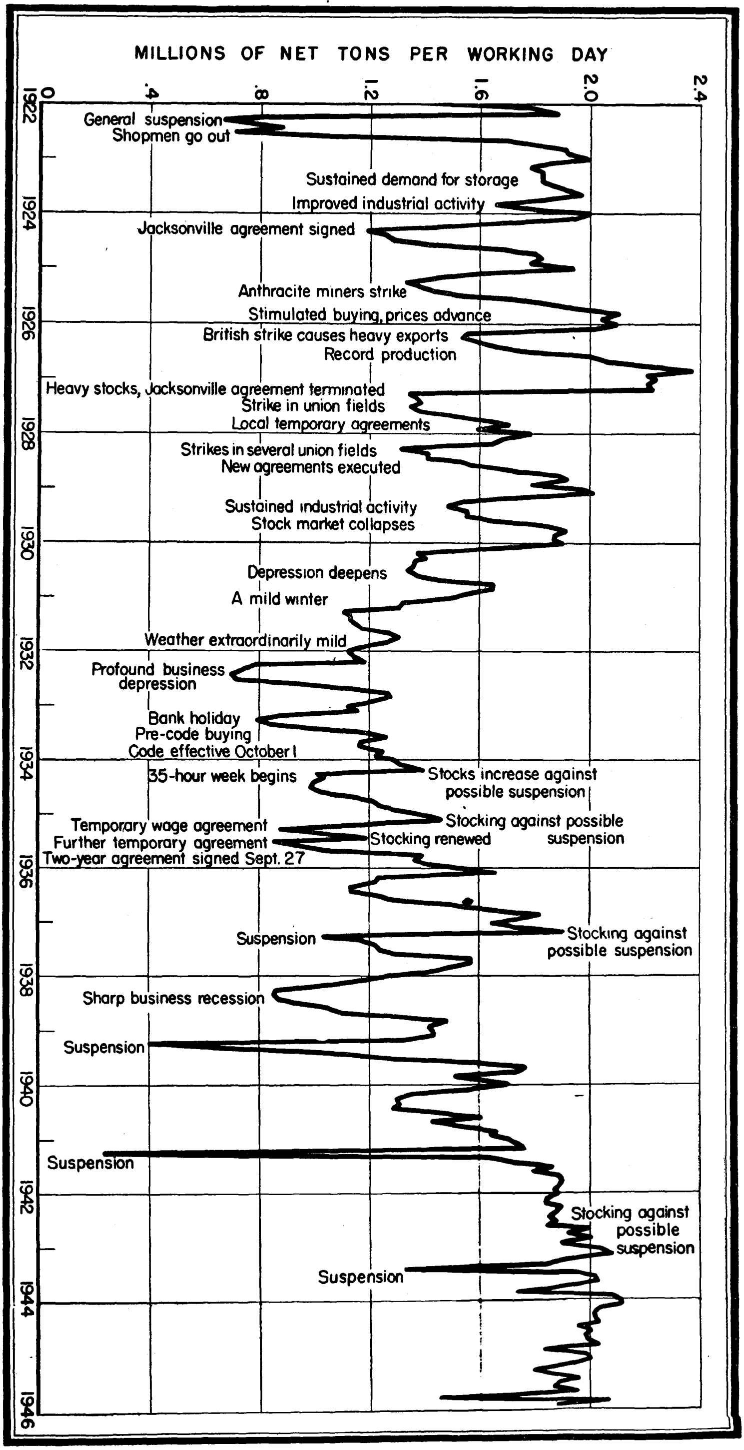

FIGURE 3.—Average production of bituminous coal and lignite in the United States per working day in each month, 1922–45.

SALIENT STATISTICS

TABLE 1.—*Salient statistics of the bituminous-coal and lignite industry in the United States, 1944–45*

[All tonnage figures represent net tons]

	1944	1945 (preliminary)	Change in 1945
			Percent
Production	619, 576, 240	576, 000, 000	−7. 0
Consumption in the United States [1]	591, 830, 000	560, 060, 000	−5. 4
Stocks at end of year:			
Industrial consumers and retail yards	57, 204, 000	45, 667, 000	−20. 2
Stocks on upper Lake docks	6, 159, 448	5, 049, 242	−18. 0
Unbilled loads, at mines or in classification yards [2]	37, 900	37, 050	−2. 2
Price indicators (average per net ton):			*Cents*
Average cost of railroad fuel purchased, f. o. b. mines [3]	$2. 65	$2. 78	+13
Average cost of coking coal at merchant byproduct ovens [4]	$5. 64	$5. 98	+34
Average retail price—35 cities [5]	$10. 27	$10. 49	+22
Average railroad freight charge per net ton [6]	$2. 21	$2. 20	−1
Underground loading machinery sold:[7]			*Percent*
Mobile loading machines (number)	282	349	+23. 8
Scrapers (number)	20	6	−70. 0
Conveyors, including those with duckbills (units)	580	738	+27. 2
"Mother" conveyors (units)	(8)	137	(8)
Surface stripping	100, 898, 376	106, 000, 000	+5. 1
Mechanically loaded underground	274, 189, 132	263, 000, 000	−4. 1
Mechanically cleaned	158, 727, 129	150, 000, 000	−5. 5
Average number of men employed at mines operating [9]	393, 347	370, 000	−5. 9
Fuel-efficiency indicators:			
Pounds of coal per kw.-hr. at electric power plants [10]	1. 30	1. 30	------------
Pounds per 1,000 gross ton-miles—railroads [11]	114	116	+1. 8

[1] Represents certain classes of consumers only. See table 5 for consumers included.
[2] Association of American Railroads.
[3] Interstate Commerce Commission (class I steam railways, including class I switching and terminal companies). Excludes freight charges.
[4] As reported by coke operators.
[5] Bureau of Labor Statistics.
[6] Average receipts per net ton of revenue bituminous coal and lignite originated, as reported by the Interstate Commerce Commission.
[7] Young, W. H., and Anderson, R. L., Sales of Mechanical Loading and Cleaning Equipment: Coal Age, February 1946, pp. 95–97, and Min. Cong. Jour., February 1946, pp. 106–109.
[8] Data not available.
[9] The figure for 1944 is based upon reports of mine operators producing over 1,000 tons. The figure for 1945 is estimated from various sources.
[10] Federal Power Commission.
[11] Interstate Commerce Commission; includes coal equivalent of fuel oil consumed.

PRODUCTION BY WEEKS AND MONTHS

The following tables summarize the preliminary statistics of weekly and monthly production of bituminous coal and lignite in 1945. The figures are estimates based upon daily and weekly statements of cars of coal and beehive coke loaded by the principal railroads and of shipments over the more important originating rivers. Allowance has been made for commercial truck shipments, local sales, and colliery fuel. The estimates given are based upon the latest information available and differ in some instances from the current figures previously published in the Weekly Coal Reports.

For method used in counting holidays, see chapter on Coal in Mineral Resources of the United States, 1930, page 631.

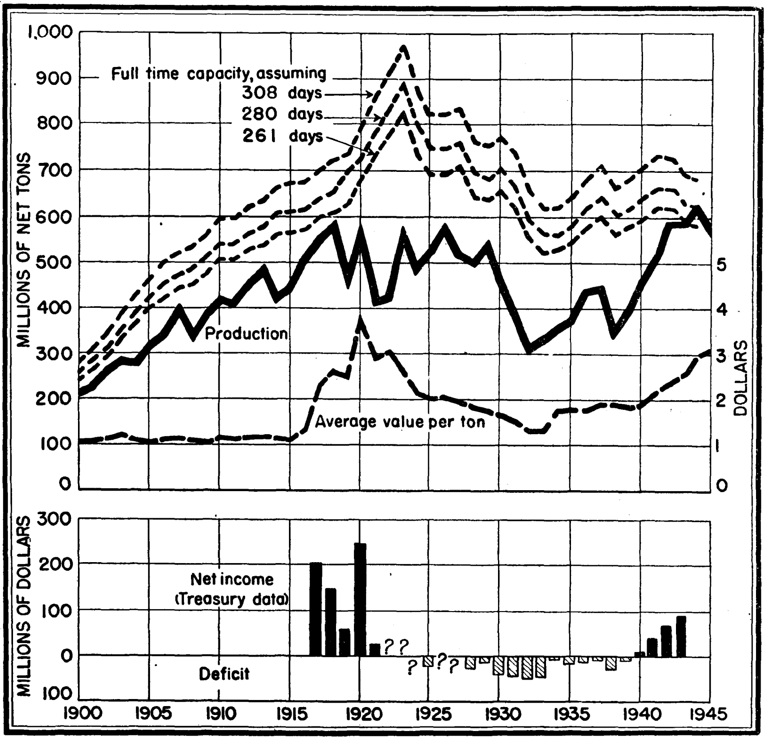

FIGURE 4.—Trends of bituminous-coal and lignite production, realization, mine capacity, and net income or deficit in the United States, 1900–1945.

TABLE 2.—*Estimated weekly production of bituminous coal and lignite in the United States in 1945*

Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 6	10,736,000	5.6	1,917,000	July 7	8,050,000	5	1,610,000
13	12,353,000	6	2,059,000	14	11,928,000	6	1,988,000
20	12,135,000	6	2,023,000	21	11,417,000	6	1,903,000
27	11,867,000	6	1,978,000	28	11,928,000	6	1,988,000
Feb. 3	11,564,000	6	1,927,000	Aug. 4	11,214,000	6	1,869,000
10	12,626,000	6	2,104,000	11	11,490,000	6	1,915,000
17	11,910,000	6	1,985,000	18	6,194,000	4.6	1,347,000
24	12,212,000	6	2,035,000	25	12,174,000	6	2,029,000
Mar. 3	11,356,000	6	1,893,000	Sept. 1	12,255,000	6	2,043,000
10	10,810,000	6	1,802,000	8	10,013,000	5	2,003,000
17	11,912,000	6	1,985,000	15	12,320,000	6	2,053,000
24	11,817,000	6	1,970,000	22	11,778,000	6	1,963,000
31	12,297,000	6	2,050,000	29	11,052,000	6	1,842,000
Apr. 7	7,716,000	5.2	1,484,000	Oct. 6	8,168,000	6	1,361,000
14	10,225,000	6	1,704,000	13	6,220,000	6	1,037,000
21	11,234,000	6	1,872,000	20	5,947,000	6	991,000
28	12,213,000	6	2,036,000	27	12,215,000	6	2,036,000
May 5	10,742,000	6	1,790,000	Nov. 3	12,489,000	6	2,082,000
12	10,532,000	6	1,755,000	10	12,490,000	6	2,082,000
19	11,234,000	6	1,872,000	17	11,518,000	5.6	2,057,000
26	11,707,000	6	1,951,000	24	10,340,000	5	2,068,000
June 2	11,132,000	5.5	2,024,000	Dec. 1	12,390,000	6	2,065,000
9	11,973,000	6	1,996,000	8	12,276,000	6	2,046,000
16	11,746,000	6	1,958,000	15	12,640,000	6	2,107,000
23	11,614,000	6	1,936,000	22	11,116,000	6	1,853,000
30	11,762,000	6	1,960,000	29	7,245,000	5	1,449,000
				Jan. 5, 1946	[1] 1,708,000	1	[2] 2,011,000
					576,000,000	305.5	1,885,000

[1] Figures represent output and number of working days in that part of week included in calendar year shown. Total production for week of Jan. 5, 1946, was 10,255,000 tons.
[2] Average daily production for entire week and not for working days in calendar year shown.

TABLE 3.—*Estimated monthly production of bituminous coal and lignite in the United States, by States, in thousands of net tons, in 1945*

[Bituminous coal and lignite figures are preliminary estimates based on railroad carloadings and river shipments of coal and beehive coke, supplemented by direct reports from a number of mining companies, local coal operators' associations, and detailed monthly production statistics compiled by the State Mine Departments of Colorado, Illinois, Pennsylvania, Washington, and West Virginia. In making the estimates, allowance is made for commercial truck shipments, local sales, and colliery fuel, and for small trucking mines producing over 1,000 tons a year. The estimates here given differ in a few cases from the monthly figures previously published in the Weekly Coal Reports]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,690	1,427	1,662	875	1,783	1,670	1,567	1,610	1,620	1,758	1,622	1,453	18,737
Alaska	31	27	31	26	22	18	20	20	21	30	28	26	300
Arkansas and Oklahoma	422	358	373	277	372	385	397	394	358	428	435	401	4,600
Colorado	763	732	767	568	520	522	504	560	583	740	684	725	7,668
Georgia and North Carolina	2	1	2	2	2	2	3	4	3	4	5	2	32
Illinois	6,930	6,210	6,693	5,560	5,755	6,100	5,400	5,530	5,778	6,679	6,060	5,830	72,525
Indiana	2,644	2,273	2,410	1,591	2,195	2,245	2,268	2,075	2,035	1,464	2,155	2,145	25,500
Iowa	196	190	193	125	152	152	150	170	156	204	168	154	2,010
Kansas and Missouri	730	655	678	537	552	523	517	583	534	568	584	534	6,995
Kentucky:													
Eastern	4,752	4,344	4,497	3,522	4,540	4,294	3,818	3,800	4,018	2,210	4,384	3,856	48,035
Western	1,697	1,474	1,587	1,543	1,723	1,676	1,675	1,625	1,548	1,935	1,683	1,674	19,840
Maryland	145	133	162	133	145	147	140	139	139	163	167	152	1,765
Michigan	11	11	11	10	11	10	8	9	11	11	11	11	125
Montana (bituminous and lignite)	462	392	454	330	356	366	354	361	317	352	386	420	4,550
New Mexico	150	129	152	112	118	118	120	114	116	131	122	118	1,500
North and South Dakota (lignite)	296	232	167	125	136	156	156	150	182	287	314	322	2,523
Ohio	2,692	2,410	2,597	2,490	2,990	3,008	2,912	3,062	2,912	2,043	2,892	2,707	32,715
Pennsylvania (bituminous)	11,370	10,670	12,087	9,850	11,445	12,422	11,383	11,310	10,636	8,007	11,612	10,858	131,650
Tennessee	663	582	605	366	618	562	530	560	560	390	642	522	6,600
Texas (bituminous and lignite)	17	14	11	7	9	7	6	6	7	8	9	7	108
Utah	660	590	620	532	543	540	510	502	485	550	580	532	6,644
Virginia	1,696	1,612	1,656	1,345	1,670	1,588	1,424	1,386	1,458	1,414	1,546	1,310	18,105
Washington	140	123	140	111	108	107	96	102	98	120	114	117	1,376
West Virginia:													
Southern [1]	9,828	9,185	9,431	8,288	8,880	8,869	7,987	8,391	8,528	5,508	9,101	7,844	101,840
Northern [2]	4,074	3,599	4,593	4,339	4,046	4,713	4,499	4,444	4,082	3,240	4,538	4,193	50,360
Wyoming	933	776	870	696	792	787	773	751	752	947	929	884	9,890
Other Western States	1	1	1	(3)	(3)	(3)	(3)	(3)	1	1	1	1	7
Total	52,995	48,150	52,450	43,360	49,483	50,987	47,217	47,658	46,938	39,192	50,772	46,798	576,000

[1] Includes operations on the N. & W., C. & O., Virginian, K. & M., B. C. & G., and on the B. & O., in Kanawha, Mason, and Clay Counties.
[2] Rest of State, including the Panhandle district and Grant, Mineral, and Tucker Counties.
[3] Less than 500 tons.

AVERAGE VALUE BY STATES

TABLE 4.—*Average value per ton, f. o. b. mines, of bituminous coal and lignite in the United States, by States, 1944–45* [1]

State	1944	1945 (preliminary)	State	1944	1945 (preliminary)
Alabama	$3.97	$4.12	North and South Dakota (lignite)	$1.50	$1.58
Alaska	6.43	6.35	Ohio	2.65	2.84
Arkansas	4.67	5.16	Oklahoma	3.47	3.44
Colorado	3.58	3.61	Pennsylvania	3.15	3.29
Georgia	3.81	4.12	Tennessee	3.26	3.49
Illinois	2.23	2.36	Texas (lignite)	.87	.83
Indiana	2.25	2.31	Utah	3.09	3.45
Iowa	3.50	3.48	Virginia	3.23	3.38
Kansas	2.58	2.46	Washington	4.83	5.26
Kentucky	2.93	2.96	West Virginia	3.01	3.29
Maryland	3.43	3.46	Wyoming	2.69	2.94
Michigan	5.45	5.78	Other States [2]	3.44	2.95
Missouri	2.58	2.46			
Montana (bituminous and lignite)	1.92	1.90	Total	2.92	3.08
New Mexico	3.79	3.95			

[1] Average gross realization; selling cost not deducted.
[2] Includes Arizona and Oregon.

CONSUMPTION

TABLE 5.—*Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1936–45, in thousands of net tons*

Year	Colliery fuel	Electric power utilities [1]	Bunker, foreign trade [2]	Railroads (class I) [3]	Coke		Steel and rolling mills	Coal-gas retorts	Cement mills [4]	Other industrials [5]	Retail dealer deliveries [5]	Total of classes shown
					Beehive ovens	By-product ovens						
1936	3, 227	40, 029	1, 622	86, 391	2, 698	63, 244	13, 471	1, 945	4, 771	108, 620	84, 200	410, 218
1937	3, 052	42, 871	1, 832	88, 080	4, 927	69, 575	12, 853	1, 680	5, 247	122, 410	80, 076	432, 603
1938	2, 493	38, 245	1, 352	73, 921	1, 360	45, 266	8, 412	1, 644	4, 483	92, 390	68, 520	338, 086
1939	2, 565	43, 979	1, 477	79, 072	2, 298	61, 216	9, 808	1, 614	5, 274	[6] 66, 569	[6] 103, 901	377, 773
1940	2, 443	50, 973	1, 426	85, 130	4, 803	76, 583	10, 040	1, 746	5, 633	[6] 76, 945	[6] 117, 035	432, 757
1941	2, 489	61, 861	1, 643	97, 384	10, 529	82, 609	10, 902	1, 659	6, 832	[6] 98, 308	[6] 119, 872	494, 088
1942	2, 708	65, 636	1, 585	115, 410	12, 876	87, 974	10, 434	1, 721	7, 570	[6] 107, 528	[6] 128, 772	542, 214
1943	2, 702	76, 403	1, 647	130, 283	12, 441	90, 019	11. 238	1, 605	5, 851	[6] 134, 975	[6] 129, 000	596, 164
1944	2, 712	78, 887	1, 559	132, 049	10, 858	94, 438	10, 734	1, 545	3, 789	[6] 122, 464	[6] 132, 795	591, 830
1945 [7]	2, 523	71, 626	1, 785	125, 120	8, 098	87, 640	10, 084	[8]	4, 215	[6] 118, 969	[6] 130, 000	560, 060

[1] Geological Survey and Federal Power Commission. Represents bituminous coal and lignite consumed by public-utility power plants in power generation, including a small quantity of coke amounting to approximately 100,000 tons annually.
[2] U. S. Bureau of Census.
[3] Association of American Railroads. Represents consumption of bituminous coal and lignite by class I railways for all uses, including locomotive, powerhouse, shop, and station fuel. The Interstate Commerce Commission reports that in 1944 consumption for all uses by class I line-haul railways plus purchases for class II and class III railways, plus purchases by all switching and terminal companies combined, was 136,303,060 tons of bituminous coal and lignite. Similar data from the Interstate Commerce Commission are not yet available for 1945.
[4] Includes a small amount of anthracite.
[5] Estimates based upon reports collected by the Solid Fuels Administration for War from a selected list of representative manufacturing plants and retail dealers.
[6] For the years 1939 to 1945, inclusive, the "Retail dealer deliveries" have been revised to include truck shipments from mines and "Other industrials" has been lowered accordingly. The tonnages shown for 1944 in M. M. S. 1289 under retail dealer use represent reported shipments by producers, wholesalers, sales agents, etc., via rail and water movements only.
[7] Subject to revision.
[8] Included in "Other industrials."

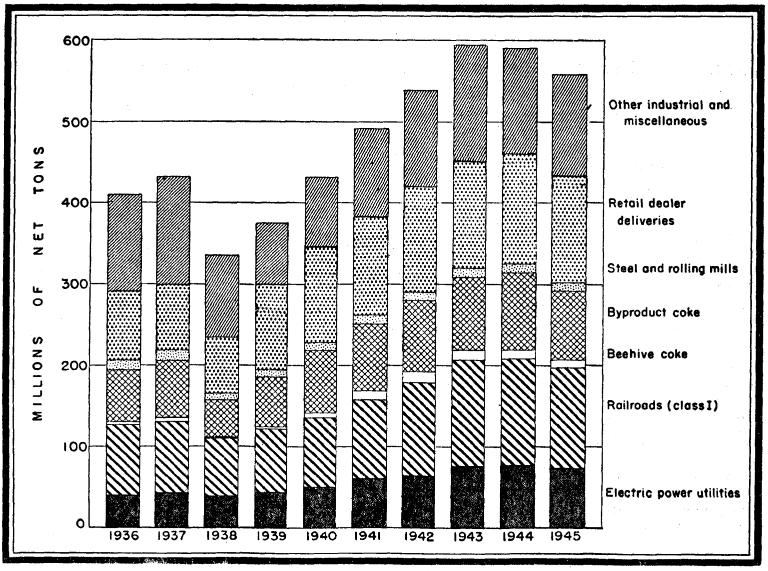

FIGURE 5.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States, 1936–45.

FUEL EFFICIENCY

TABLE 6.—*Indicators of effect of fuel economy on consumption of coal in the United States per unit of performance since the World War of 1914–18*

	Pounds	Reduction from base period (percent)
Steam railroads:		
Pounds per 1,000 gross ton-miles freight service:		
Average:		
1919–20	170	
1944	114	32.9
1945	116	31.8
Pounds per passenger-train car-mile:		
Average:		
1919–20	18.5	
1944	14.8	20.0
1945	14.9	19.5
Electric public-utility power plants:		
Pounds per kilowatt-hour:		
1919	3.2	
1944	1.3	59.4
1945	1.3	59.4
Iron and steel—pounds coking coal per net ton of pig: [1]		
1918	3,194	
1944	2,629	17.7
1945	2,635	17.5
Coke manufacture: Savings of heat values through recovery of gas, tar, light oils, and breeze by extension of byproduct in place of beehive coking, 1913–14, expressed as percent of coal used for all coke in 1945 [2]		19.7

[1] Includes only savings through higher yields of merchantable coke per ton of coal charged and lower consumption of coke per ton of iron. Excludes economies through recovery of byproducts, which are covered in next item.

[2] These byproducts are used in part for boiler fuel, in part for metallurgical purposes, in part for domestic heating and coking, and to a small extent for automotive fuel.

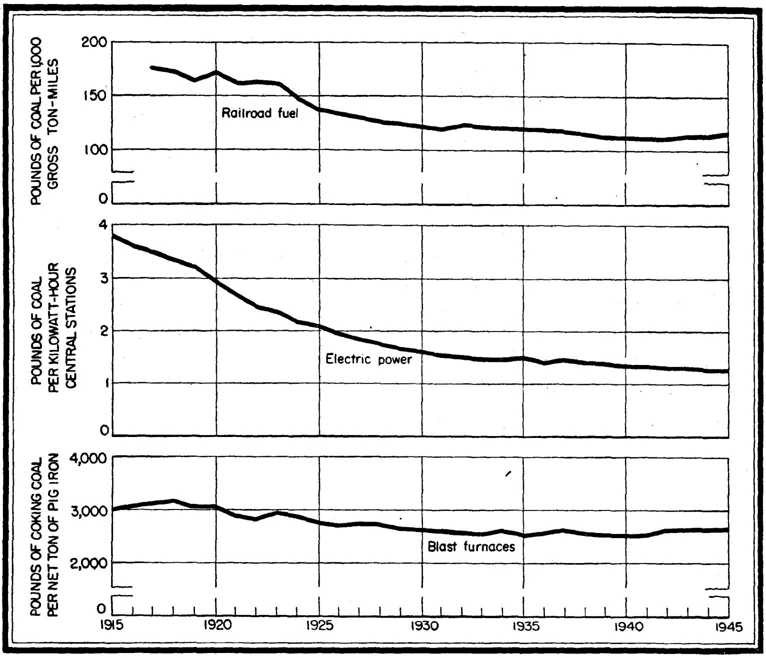

FIGURE 6.—Trends in fuel efficiency in the United States, 1915–45.

RELATIVE RATE OF GROWTH OF COAL, OIL, AND WATER POWER, 1889–1945

The total supply of available energy in the form of coal, oil, natural gas, and water power in 1945 was 35,283 trillion B. t. u.—a 3.1 percent decrease from 1944 (see fig. 7).

The figures are expressed in British thermal units because some common denominator is necessary for such unlike quantities as tons of coal, barrels of oil, and cubic feet of gas. Table 7 summarizes the equivalent of each of the fuels in trillions of British thermal units. Water power is represented by the equivalent fuel required to perform the same work. The table covers the years since 1936. Details for 1889 to 1935 are given in Minerals Yearbook, 1937, page 807.

In converting water power to its fuel equivalent, two alternative assumptions have been made. The first, as in previous issues of these tables, assumes a *constant* fuel equivalent of 4.02 pounds of coal for each kilowatt-hour of water power produced throughout the entire period from 1889 to 1945. This factor was selected because it represents, in round numbers, the average efficiency of all central stations generating steam-electric power in 1913, the base period used. The usefulness of the *constant* factor lies in showing the rate at which water power is being developed. It permits direct comparison between the relative increase (in kilowatt-hours of water power) and the corresponding increase or decrease (in tons of coal, barrels of oil, or cubic feet of gas produced). On the other hand, the *constant* factor makes no allowance for the fact that coal and other fuels produced today are used more efficiently than formerly.

To show the influence of improving fuel efficiency, a second computation of the energy equivalent of water power has therefore been made. This assumes a *prevailing* fuel equivalent, diminishing year by year, which represents the average performance of all fuel-burning central electric stations for the year in question. This average has declined from about 7.05 pounds of coal per kilowatt-hour in 1899 to 1.30 pounds in 1945. (The *prevailing* factor is thus much above the *constant* factor in 1899 and much below it in 1945.) The *prevailing* fuel equivalent indicates more nearly the quantity of fuel that would have been needed in any one year to generate the same power in a steam-electric station. It should be noted, however, that the ultimate uses to which the water power generated is put often displace fuel burned much less efficiently than in central stations and that in any instance no other important branch of fuel consumption has made advances in fuel efficiency approaching that of the central stations.

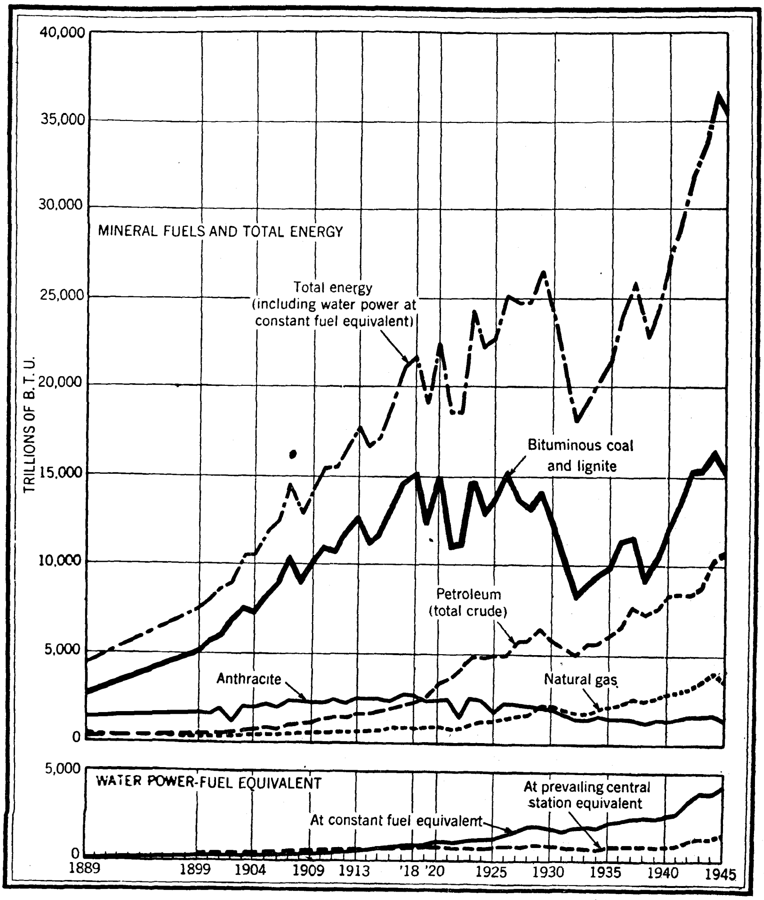

FIGURE 7.—Annual supply of energy from mineral fuels and water power in the United States, 1889–1945.

As these tables attempt to determine the total energy from all fuels and from water power, the ideal factor for converting water power into fuel equivalent would be the average efficiency of all forms of fuel consumption in each year. No basis for determining such an all-embracing average exists at present, but enough is known to make certain that it would show much less reduction from 1899 to 1945 than do the central stations. For the present, a just comparison of the changing contributions of water power and of fuel to the national energy supply would lie somewhere between the results shown by the *constant* equivalent and the *prevailing* central-station equivalent in these tables.

As in earlier issues of these tables, the figures for oil and natural gas represent the entire production of crude petroleum and of gas. Most of this production does not come into direct competition with coal. Much of the supply of both oil and gas is used in regions of the country, such as California and portions of the Southwest, where coal is available only at unusually high cost because of heavy transport charges. Nearly half of the natural gas is used in the field for drilling or operating oil and gas wells and pipe lines or for the manufacture of carbon black. More than half the oil is used in the form of gasoline, kerosine, and lubricants, for which purposes coal cannot well compete, except at very much higher levels of oil prices. Even these refined products, however, involve a certain measure of indirect competition with coal, for the energy market of the country is becoming more fluid and competitive, and a demand that cannot be met by one source of supply tends to fall back on the others.

The subject of interfuel competition is exceedingly complex, and an elaborate analysis and the accumulation of data not now available would be required to determine even approximately how much of any one fuel actually has been displaced either by other fuels or

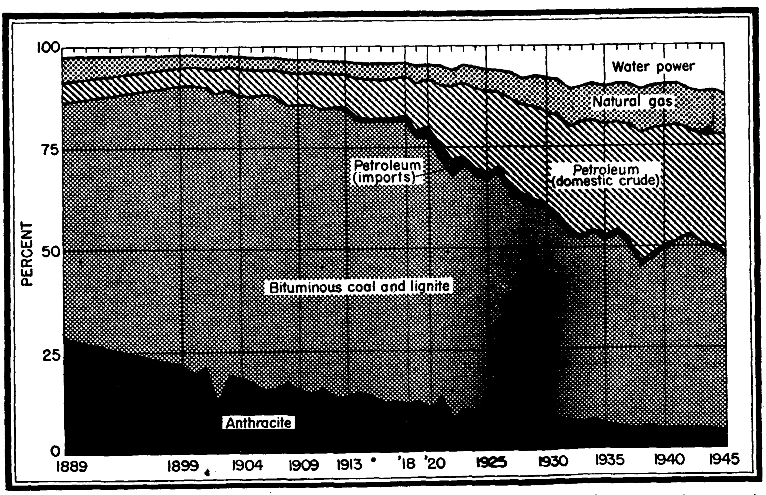

FIGURE 8.—Percentage of total B. t. u. equivalent contributed by the several sources of energy in the United States, counting water power at constant fuel equivalent, 1889–1945. If water power is counted at the prevailing fuel equivalent of central stations in each year, its proportion is 3.2 percent in 1899 and 4.3 percent in 1945, and the proportions of the other sources of energy are affected accordingly.

by water power. The present tables do not permit determination of such displacement; their purpose is rather to measure the long-time trends in the total demand for energy.

TABLE 7.—*Annual supply of energy from mineral fuels and water power in the United States, 1936–45,[1] in trillions of B. t. u.[2]*

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude, including that refined)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (fuel equivalent)		Grand total energy	
				Domestic production	Imports				At constant fuel equivalent [3]	At prevailing central station equivalent [4]	Water power at constant fuel equivalent	Water power at prevailing central station equivalent
1936	1,485	11,504	12,989	6,598	194	2,330	9,122	22,111	2,256	812	24,367	22,923
1937	1,410	11,673	13,083	7,675	165	2,588	10,428	23,511	2,446	871	25,957	24,382
1938	1,255	9,132	10,387	7,286	158	2,468	9,912	20,299	2,466	866	22,765	21,165
1939	1,400	10,345	11,745	7,590	199	2,663	10,452	22,197	2,423	838	24,620	23,035
1940	1,400	12,072	13,472	8,119	256	2,860	11,235	24,707	2,620	880	27,327	25,587
1941	1,533	13,471	15,004	8,413	304	3,024	11,741	26,745	2,804	934	29,549	27,679
1942	1,641	15,267	16,908	8,320	74	3,282	11,676	28,584	3,485	1,136	32,069	29,720
1943	1,650	15,463	17,113	9,034	83	3,671	12,788	29,901	3,999	1,304	33,900	31,205
1944 [5]	1,733	16,233	17,966	10,067	269	4,064	14,400	32,366	4,029	1,301	36,395	33,667
1945 [5]	1,485	15,091	16,576	10,267	445	3,662	14,374	30,950	4,333	1,399	35,283	32,349

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 807.

[2] The unit heat values employed are: Anthracite, 13,600 B. t. u. per pound; bituminous coal and lignite, 13,100 B. t. u. per pound; petroleum, 6,000,000 B. t. u. per barrel; natural gas, 1,075 B. t. u. per cubic foot. Water power includes installations owned by manufacturing plants and mines, as well as Government and privately owned public utilities. The fuel equivalent of water power is calculated from the kilowatt-hours of power produced wherever available, as is true of all public-utility plants since 1919. Otherwise, the fuel equivalent is calculated from the reported horsepower of installed water wheels, assuming a capacity factor of 20 percent for manufacturers and mines for the years 1936 to 1943.

[3] Assuming 4.02 pounds per kilowatt-hour, which is the average of central electric station practice in 1913, the base period used.

[4] Assuming the average central-station practice for each of the years for which data are available, which declined from about 7.05 pounds per kilowatt-hour in 1899 to 1.30 pounds in 1945.

[5] Subject to revision.

TABLE 8.—*Index numbers for relative rate of growth of coal, oil, and water power in the United States, 1936–45 [1]*

[Figures expressed as percentage of 1918 rate]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power (at constant fuel equivalent)	Grand total	
				Domestic production	Imports					With water power at constant fuel equivalent	With water power at prevailing central station equivalent
1936	55	76	73	309	86	301	291	105	270	112	106
1937	52	77	73	359	73	334	332	112	292	119	112
1938	47	60	58	341	70	318	316	97	295	104	98
1939	52	68	66	355	88	344	333	106	289	113	106
1940	52	80	75	380	113	369	358	118	313	125	118
1941	57	89	84	394	135	390	374	127	335	135	128
1942	61	101	95	390	33	423	372	136	416	147	137
1943	61	102	96	423	37	474	408	142	478	155	144
1944 [2]	64	107	101	471	119	524	459	154	481	167	155
1945 [2]	55	99	93	481	197	473	458	147	518	162	149

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 809. [2] Subject to revision.

TABLE 9.—*Percentage of total B. t. u. equivalent contributed by the several mineral fuels and water power in the United States, 1936–45* [1]

Year	Pennsylvania anthracite	Bituminous coal and lignite	Total coal	Petroleum (total crude)		Natural gas (total production)	Total petroleum and natural gas	Total mineral fuels	Water power, fuel equivalent	Grand total, including water power
				Domestic production	Imports					
	Water power counted at constant fuel equivalent of approximately 4 pounds per kilowatt-hour									
1936	6.1	47.2	53.3	27.1	0.8	9.5	37.4	90.7	9.3	100.0
1937	5.4	45.0	50.4	29.6	.6	10.0	40.2	90.6	9.4	100.0
1938	5.5	40.1	45.6	32.0	.7	10.8	43.5	89.1	10.9	100.0
1939	5.7	42.0	47.7	30.8	.8	10.8	42.4	90.1	9.9	100.0
1940	5.1	44.2	49.3	29.7	.9	10.5	41.1	90.4	9.6	100.0
1941	5.2	45.6	50.8	28.5	1.0	10.2	39.7	90.5	9.5	100.0
1942	5.1	47.6	52.7	26.0	.2	10.2	36.4	89.1	10.9	100.0
1943	4.9	45.6	50.5	26.7	.2	10.8	37.7	88.2	11.8	100.0
1944 [2]	4.8	44.6	49.4	27.7	.7	11.1	39.5	88.9	11.1	100.0
1945 [2]	4.2	42.8	47.0	29.0	1.3	10.4	40.7	87.7	12.3	100.0
	Water power counted at prevailing central-station equivalent for year									
1936	6.5	50.2	56.7	28.8	0.8	10.2	39.8	96.5	3.5	100.0
1937	5.8	47.8	53.6	31.5	.7	10.6	42.8	96.4	3.6	100.0
1938	5.9	43.2	49.1	34.4	.7	11.7	46.8	95.9	4.1	100.0
1939	6.1	44.9	51.0	32.9	.9	11.6	45.4	96.4	3.6	100.0
1940	5.5	47.2	52.7	31.7	1.0	11.2	43.9	96.6	3.4	100.0
1941	5.5	48.7	54.2	30.4	1.1	10.9	42.4	96.6	3.4	100.0
1942	5.5	51.4	56.9	28.0	.2	11.1	39.3	96.2	3.8	100.0
1943	5.3	49.5	54.8	28.9	.3	11.8	41.0	95.8	4.2	100.0
1944 [2]	5.1	48.2	53.3	29.9	.8	12.1	42.8	96.1	3.9	100.0
1945 [2]	4.6	46.7	51.3	31.7	1.4	11.3	44.4	95.7	4.3	100.0

[1] Comparable data for earlier years in Minerals Yearbook, 1937, p. 810.
[2] Subject to revision. Percentages based upon figures in table 7.

DISTRIBUTION

TABLE 10.—*Trends in distribution of bituminous coal and lignite in the United States, 1939–45*

[For details and sources of data, see Monthly Report on Distribution of Coal Shipments. Tonnage figures shown in thousands of net tons]

	1939		1940		1941		1942		1943		1944		1945	
	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent	M net tons	Percent
New England receipts:														
Via rail across the Hudson	4,626	-------	4,892	-------	6,385	-------	9,894	-------	10,365	-------	9,571	-------	7,872	-------
Lake Erie loadings (cargo and fuel):														
By fields of origin:														
From Ohio	2,356	5.7	2,646	5.5	3,947	7.7	4,171	8.5	4,682	9.9	4,995	9.0	4,322	8.4
From Pittsburgh and other Pennsylvania	9,259	22.5	11,578	24.1	11,612	22.6	9,305	18.8	8,409	17.7	10,568	19.0	9,601	18.7
From Moundsville, Fairmont, and Cumberland-Piedmont	1,963	4.8	2,357	4.9	2,963	5.8	2,778	5.6	2,763	5.8	3,678	6.6	3,645	7.1
From Southern West Virginia:														
High volatile	10,883	26.5	12,025	25.0	14,277	27.8	14,746	29.8	14,256	30.1	13,902	25.1	12,281	24.0
Low volatile	8,665	21.1	10,372	21.6	9,010	17.5	9,160	18.5	8,653	18.2	10,797	19.5	10,021	19.5
From East Kentucky, Tennessee, and Virginia	7,998	19.4	9,133	18.9	9,585	18.6	9,295	18.8	8,692	18.3	11,551	20.8	11,438	22.3
Total	41,124	100.0	48,111	100.0	51,394	100.0	49,455	100.0	47,455	100.0	55,491	100.0	51,308	100.0
By destinations (cargo only):														
To American points	33,188	83.3	37,804	81.2	38,823	78.1	36,267	75.9	34,146	74.1	41,773	77.4	39,061	78.3
To Canadian points	6,672	16.7	8,778	18.8	10,886	21.9	11,544	24.1	11,939	25.9	12,210	22.6	10,836	21.7
Total	39,860	100.0	46,582	100.0	49,709	100.0	47,811	100.0	46,085	100.0	53,983	100.0	49,897	100.0
Across Lake Michigan car ferry	592	-------	612	-------	627	-------	740	-------	769	-------	645	-------	522	-------
West-bound rail to Mississippi Valley (revenue all-rail shipments, excluding railroad fuel, Lake coal, and movements to Kentucky points):														
From Ohio fields	9,052	8.4	9,807	8.0	10,846	7.9	11,719	7.4	12,679	7.6	14,289	8.3	14,991	9.4
From Pennsylvania fields	12,200	11.4	15,195	12.4	16,663	12.1	18,141	11.5	18,189	11.0	19,175	11.2	17,184	10.8
From Northern West Virginia and Cumberland-Piedmont	3,227	3.0	3,467	2.8	4,728	3.4	5,201	3.3	6,268	3.8	7,728	4.5	7,236	4.6
From Southern West Virginia:														
High volatile	15,099	14.0	16,943	13.8	18,275	13.3	21,500	13.6	22,739	13.6	22,222	13.0	19,205	12.1
Low volatile	15,946	14.8	19,536	15.9	22,773	16.6	25,005	15.9	24,477	14.7	21,717	12.7	18,919	11.9
From East Kentucky, Tennessee, and Virginia	15,749	14.7	18,340	14.9	18,980	13.8	22,770	14.4	23,010	13.8	20,921	12.2	18,350	11.5
Total from Appalachian fields	71,273	66.3	83,288	67.8	92,265	67.1	104,336	66.1	107,362	64.5	106,052	61.9	95,885	60.3

From Illinois	24,879	23.1	27,618	22.5	30,100	21.9	36,992	23.4	42,326	25.4	46,240	27.0	44,125	27.7
From Indiana	9,455	8.8	10,223	8.3	12,499	9.0	14,031	8.9	13,680	8.2	15,571	9.1	14,730	9.3
From West Kentucky	1,917	1.8	1,758	1.4	2,735	2.0	2,556	1.6	3,195	1.9	3,408	2.0	4,238	2.7
Total from Middle West fields	36,251	33.7	39,599	32.2	45,334	32.9	53,579	33.9	59,201	35.5	65,219	38.1	63,093	39.7
Grand total	107,524	100.0	122,887	100.0	137,599	100.0	157,915	100.0	166,563	100.0	171,271	100.0	158,978	100.0
Total shipments from other groups (all shipments, including, in this case, nonrevenue railroad fuel): [1]														
From Michigan fields	122	([2] [3])	103	([2] [3])	120	([2] [3])	71	([2] [3])	56	([2] [3])	57	([2] [3])	42	([2] [3])
From upper Lake commercial docks, all deliveries	11,111	[2] 2.8	12,054	[2] 2.6	12,473	[2] 2.4	14,036	[2] 2.4	15,867	[2] 2.7	15,095	[2] 2.4	14,668	[2] 2.5
From Iowa, Missouri, Kansas	6,088	[2] 1.5	6,411	[2] 1.4	6,731	[2] 1.3	7,361	[2] 1.3	8,246	[2] 1.4	8,280	[2] 1.3	7,184	[2] 1.2
From Arkansas, Oklahoma, Texas	2,946	[2] .7	3,394	[2] .7	3,411	[2] .7	4,348	[2] .7	4,226	[2] .7	4,415	[2] .7	4,453	[2] .8
From Far West fields	18,442	[2] 4.7	19,658	[2] 4.3	22,009	[2] 4.3	27,154	[2] 4.7	28,724	[2] 4.9	29,855	[2] 4.8	29,164	[2] 5.1
From Alabama field	11,233	[2] 2.8	14,288	[2] 3.1	14,310	[2] 3.1	17,525	[2] 3.0	16,270	[2] 2.8	17,926	[2] 2.9	17,459	[2] 3.0

[1] Excluding commercial sales by truck and wagon, except from upper Lake docks.
[2] Percent of total national production from all mines, all destinations.
[3] Less than 0.1 percent.

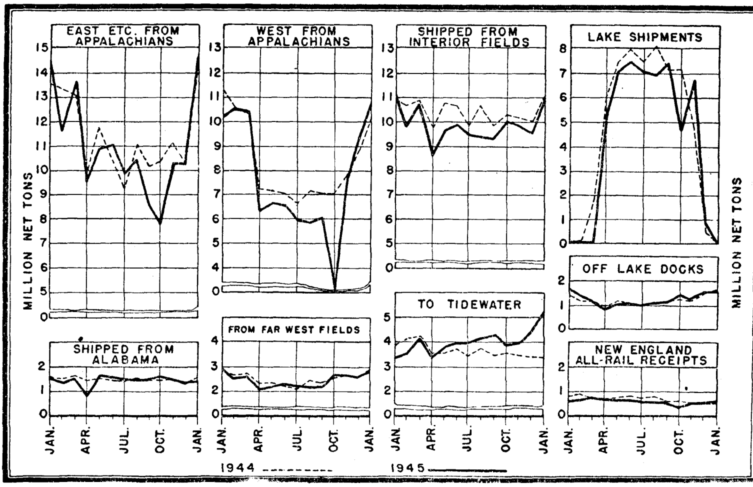

FIGURE 9.—Monthly movement of bituminous coal and lignite in the United States in the major channels of distribution, 1944–45.

STOCKS HELD BY CONSUMERS

TABLE 11.—*Stocks of bituminous coal and lignite in hands of commercial consumers and in retail dealers' yards in the United States, 1944–45*

Date	Total stocks (net tons)	Days' supply at current rate of consumption on date of stock taking								
		By-product-coke plants	Steel plants	Other industrials	Coal-gas plants	Electric utilities	Retail yards	Railroads	Cement mills	Total
1944										
Jan. 1	56, 686, 000	25	22	43	60	61	12	25	42	30
Feb. 1	53, 628, 000	24	23	42	54	59	12	24	54	30
Mar. 1	52, 720, 000	24	22	38	47	60	13	24	52	29
Apr. 1	51, 835, 000	24	23	38	45	66	12	25	55	30
May 1	50, 513, 000	22	26	40	44	79	11	27	56	32
June 1	55, 293, 000	22	28	51	50	83	19	34	50	39
July 1	59, 680, 000	24	30	56	55	80	21	39	47	42
Aug. 1	61, 413, 000	22	32	64	57	82	23	42	50	44
Sept. 1	63, 909, 000	23	29	62	64	77	18	43	47	43
Oct. 1	64, 905, 000	24	29	59	62	80	18	44	49	43
Nov. 1	65, 074, 000	25	28	52	59	82	17	42	50	41
Dec. 1	64, 020, 000	26	26	44	61	78	17	40	49	39
Dec. 31	57, 204, 000	24	21	38	55	72	11	34	47	32
1945										
Jan. 1	57, 204, 000	24	21	38	55	72	11	34	47	32
Feb. 1	49, 464, 000	22	19	31	46	61	6	29	52	26
Mar. 1	45, 773, 000	22	20	29	40	58	6	27	51	24
Apr. 1	45, 495, 000	21	24	33	39	63	9	27	52	27
May 1	43, 793, 000	18	24	35	39	63	15	27	44	30
June 1	44, 020, 000	17	25	36	44	65	14	27	45	30
July 1	47, 715, 000	21	28	41	50	69	18	29	46	33
Aug. 1	49, 906, 000	19	27	51	(1)	73	21	31	46	37
Sept. 1	51, 141, 000	19	30	53	(1)	76	20	33	43	38
Oct. 1	53, 350, 000	19	33	56	(1)	88	20	35	45	41
Nov. 1	48, 015, 000	20	21	44	(1)	84	15	32	41	36
Dec. 1	48, 919, 000	20	22	39	(1)	83	13	31	42	33
Dec. 31	45, 665, 000	20	20	32	(1)	78	8	25	43	27

[1] Included in "Other industrials."

FINAL BITUMINOUS-COAL AND LIGNITE STATISTICS FOR 1944

Tables 12 to 53 give the final detailed statistics of bituminous-coal and lignite-mine operations in 1944. The subjects covered include production, number and size of mines, employment, value, mechanization, exports, and world production.

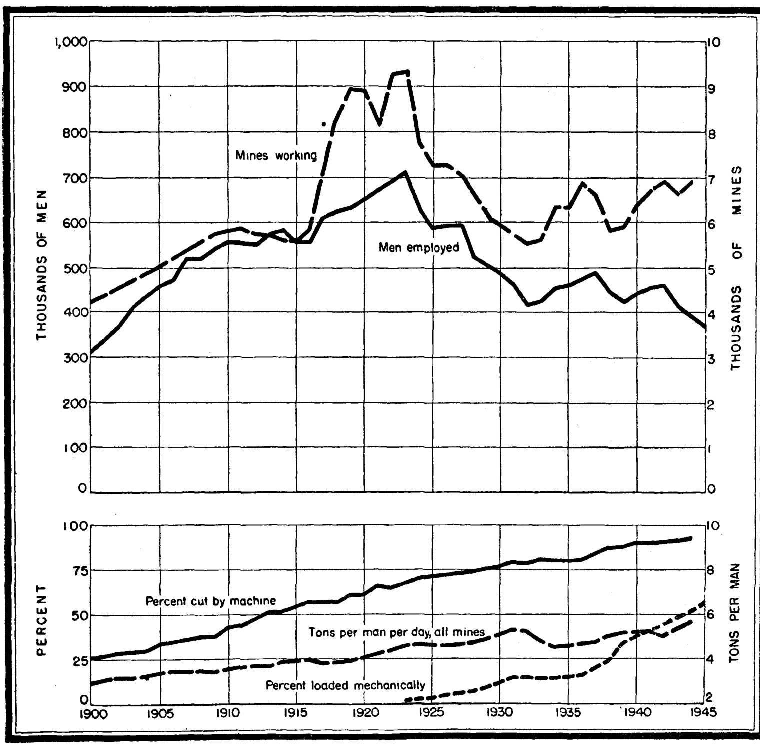

FIGURE 10.—Trends of employment, mechanization, and output per man at bituminous-coal and lignite mines in the United States, 1900–1945.

SALIENT TRENDS

TABLE 12.—*Salient trends in bituminous-coal and lignite-mining industry in the United States, 1937–44.*

	1937	1938	1939	1940	1941	1942	1943	1944
Production:								
Loaded at mine for shipment by rail ..... net tons	[1] 399, 237, 575	295, 336, 027	331, 189, 620	380, 387, 674	425, 184, 319	482, 814, 042	495, 863, 581	527, 135, 489
Loaded at mine for shipment by water ..... do	(1)	16, 902, 969	22, 229, 364	29, 493, 058	30, 240, 489	34, 018, 025	30, 188, 093	31, 518, 334
Shipped by truck or wagon ..... do	[2] 37, 762, 612	25, 592, 058	29, 533, 824	35, 540, 476	40, 055, 638	45, 154, 432	42, 432, 667	40, 123, 023
Taken by locomotive tenders at tipple ..... do	(2)	606, 857	826, 556	939, 058	1, 099, 582	920, 213	779, 154	807, 679
Shipped by conveyor or tram to point of consumption ..... do	(2)	4, 221, 671	4, 317, 465	5, 887, 994	6, 067, 697	7, 121, 116	7, 476, 717	7, 206, 392
Used by mine employees ..... do	(2)	2, 032, 289	1, 901, 408	2, 035, 201	1, 872, 026	2, 180, 077	2, 549, 775	2, 545, 343
Used at mines for power and heat ..... do	3, 052, 095	2, 493, 017	2, 565, 276	2, 442, 989	2, 488, 950	2, 708, 312	2, 701, 828	2, 713, 073
Made into beehive coke at mines ..... do	4, 884, 054	1, 359, 876	2, 089, 475	4, 045, 050	7, 140, 544	7, 776, 720	8, 185, 254	7, 526, 907
Total production ..... do	[3] 445, 531, 449	348, 544, 764	[4] 394, 855, 325	460, 771, 500	514, 149, 245	582, 692, 937	590, 177, 069	619, 576, 240
Number of active mines of commercial size:								
Class 1 (200,000 tons or more) ..... number	661	526	577	636	730	811	855	828
Class 2 (100,000 to 200,000 tons) ..... do	469	402	404	432	437	484	464	559
Class 3 (50,000 to 100,000 tons) ..... do	448	415	387	371	402	445	481	540
Class 4 (10,000 to 50,000 tons) ..... do	1, 117	1, 042	1, 065	1, 157	1, 305	1, 492	1, 544	1, 776
Class 5 (1,000 to 10,000 tons) ..... do	3, 853	3, 392	3, 387	3, 728	3, 948	3, 740	3, 276	3, 225
Total number over 1,000 tons ..... do	6, 548	5, 777	5, 820	6, 324	6, 822	6, 972	6, 620	6, 928
Average number of men employed at mines active:								
Underground ..... men	(5)	370, 004	353, 476	365, 013	376, 765	374, 654	326, 763	301, 461
Surface:								
In strip pits ..... do	(5)	7, 877	8, 791	8, 983	10, 861	12, 893	16, 643	21, 035
All others ..... do	(5)	63, 452	59, 521	65, 079	69, 355	74, 444	72, 601	70, 851
Total ..... do	491, 864	441, 333	421, 788	439, 075	456, 981	461, 991	416, 007	393, 347
Average number of days mines operated ..... days	193	162	178	202	216	246	264	278
Capacity of active mines with existing labor force:								
Per year of 308 days ..... net tons	710, 000, 000	663, 000, 000	683, 000, 000	703, 000, 000	733, 000, 000	730, 000, 000	689, 000, 000	686, 000, 000
Per year of 280 days ..... do	646, 000, 000	602, 000, 000	621, 000, 000	639, 000, 000	666, 000, 000	663, 000, 000	626, 000, 000	624, 000, 000
Per year of 261 days ..... do	601, 000, 000	562, 000, 000	579, 000, 000	595, 000, 000	621, 000, 000	618, 000, 000	583, 000, 000	582, 000, 000
Output per man per day ..... do	4. 69	4. 89	5. 25	5. 19	5. 20	5. 12	5. 38	5. 67
Output per man per year ..... do	906	790	936	1, 049	1, 125	1, 261	1, 419	1, 575
Underground output cut by machine ..... do	(5)	278, 315, 365	313, 969, 394	369, 227, 277	408, 510, 296	462, 344, 719	461, 051, 743	469, 458, 349
Percent of underground output cut by machine ..... percent	(5)	87. 5	87. 9	88. 4	89. 0	89. 7	90. 3	90. 5
Underground output mechanically loaded ..... net tons	83, 500, 000	85, 092, 836	110, 711, 970	147, 870, 252	186, 667, 250	232, 902, 920	249, 805, 214	274, 189, 132
Percent of underground output mechanically loaded ..... percent	20. 2	26. 7	31. 0	35. 4	40. 7	45. 2	48. 9	52. 9
Quantity mined by stripping ..... net tons	31, 750, 853	30, 406, 855	37, 722, 583	43, 167, 336	55, 071, 609	67, 202, 663	79, 685, 175	100, 898, 376
Percent mined by stripping ..... per cent	7. 1	8. 7	9. 6	9. 4	10. 7	11. 5	13. 5	16. 3
Quantity cleaned by wet or pneumatic processes [6] ..... net tons	65, 000, 000	63, 454, 588	79, 429, 426	102, 269, 753	117, 539, 522	142, 187, 346	145, 575, 849	158, 727, 129
Percent cleaned by wet or pneumatic processes [6] ..... percent	14. 6	18. 2	20. 1	22. 2	22. 9	24. 4	24. 7	25. 6

[1] In 1937, coal loaded at mine for shipment by water is included with "Loaded at mine for shipment by rail."

[2] Coal "Taken by locomotive tenders at tipple," "Shipped by conveyor or tram to point of consumption," and "Used by mine employees" included with "Shipped by truck or wagon."

[3] The total production differs from sum of items shown by amount of changes in inventory and tonnage not accounted for in distribution analysis. This amounts to 595,113 net tons.

[4] Includes 202,337 tons of coal reported as net changes in stocks at mines, Jan. 1, 1939, to Jan. 1, 1940.

[5] Data not available.

[6] Includes central washeries operated by consumers.

TABLE 13.—*Growth of the bituminous-coal and lignite-mining industry in the United States, 1890–1944*

Year	Production (net tons)	Value		Men employed	Number of mines	Calculated capacity (millions of net tons)—		
		Total [1]	Average per ton [1]			At 308 days	At 280 days	At 261 days
1890	111,302,322	$110,420,801	$0.99	192,204	(2)	152	137	129
1891	117,901,238	117,188,400	.99	205,803	(2)	163	148	138
1892	126,856,567	125,124,381	.99	212,893	(2)	178	162	151
1893	128,385,231	122,751,618	.96	230,365	(2)	194	174	164
1894	118,820,405	107,653,501	.91	244,603	(2)	214	196	181
1895	135,118,193	115,779,771	.86	239,962	2,555	215	196	182
1896	137,640,276	114,891,515	.83	244,171	2,599	221	202	187
1897	147,617,519	119,595,224	.81	247,817	2,454	232	213	197
1898	166,593,623	132,608,713	.80	255,717	2,862	243	221	206
1899	193,323,187	167,952,104	.87	271,027	3,245	254	230	216
1900	212,316,112	220,930,313	1.04	304,375	(2)	279	255	237
1901	225,828,149	236,422,049	1.05	340,235	(2)	309	281	262
1902	260,216,844	290,858,483	1.12	370,056	(2)	348	316	295
1903	282,749,348	351,687,933	1.24	415,777	(2)	387	350	328
1904	278,659,689	305,397,001	1.10	437,832	4,650	425	386	360
1905	315,062,785	334,658,294	1.06	460,629	5,060	460	417	390
1906	342,874,867	381,162,115	1.11	478,425	4,430	496	451	420
1907	394,759,112	451,214,842	1.14	513,258	4,550	520	473	440
1908	332,573,944	374,135,268	1.12	516,264	4,730	531	482	450
1909	379,744,257	405,486,777	1.07	543,152	5,775	560	510	474
1910	417,111,142	469,281,719	1.12	555,533	5,818	592	538	502
1911	405,907,059	451,375,819	1.11	549,775	5,887	593	538	502
1912	450,104,982	517,983,445	1.15	548,632	5,747	622	566	527
1913	478,435,297	565,234,952	1.18	571,882	5,776	635	577	538
1914	422,703,970	493,309,244	1.17	583,506	5,592	668	608	566
1915	442,624,426	502,037,688	1.13	557,456	5,502	672	610	569
1916	502,519,682	665,116,077	1.32	561,102	5,726	673	613	570
1917	551,790,563	1,249,272,837	2.26	603,143	6,939	699	636	593
1918	579,385,820	1,491,809,940	2.58	615,305	8,319	717	650	607
1919	465,860,058	1,160,616,013	2.49	621,998	8,994	736	669	624
1920	568,666,683	2,129,933,000	3.75	639,547	8,921	796	725	675
1921	415,921,950	1,199,983,600	2.89	663,754	8,038	860	781	729
1922	422,268,099	1,274,820,000	3.02	687,958	9,299	916	832	776
1923	564,564,662	1,514,621,000	2.68	704,793	9,331	970	885	823
1924	483,686,538	1,062,626,000	2.20	619,604	7,586	871	792	738
1925	520,052,741	1,060,402,000	2.04	588,493	7,144	822	748	696
1926	573,366,985	1,183,412,000	2.06	593,647	7,177	821	747	696
1927	517,763,352	1,029,657,000	1.99	593,918	7,011	835	759	708
1928	500,744,970	933,774,000	1.86	522,150	6,450	760	691	644
1929	534,988,593	952,781,000	1.78	502,993	6,057	752	679	638
1930	467,526,299	795,483,000	1.70	493,202	5,891	770	700	653
1931	382,089,396	588,895,000	1.54	450,213	5,642	736	669	623
1932	309,709,872	406,677,000	1.31	406,380	5,427	653	594	554
1933	333,630,533	445,788,000	1.34	418,703	5,555	615	559	521
1934	359,368,022	628,383,000	1.75	458,011	6,258	622	565	527
1935	372,373,122	658,063,000	1.77	462,403	6,315	640	582	543
1936	439,087,903	770,955,000	1.76	477,204	6,875	680	618	576
1937	445,531,449	864,042,000	1.94	491,864	6,548	710	646	601
1938	348,544,764	678,653,000	1.95	441,333	5,777	663	602	562
1939	394,855,325	728,348,366	1.84	421,788	5,820	683	621	579
1940	460,771,500	879,327,227	1.91	439,075	6,324	703	639	595
1941	514,149,245	1,125,362,836	2.19	456,981	6,822	733	666	621
1942	582,692,937	1,373,990,608	2.36	461,991	6,972	730	663	618
1943	590,177,069	1,584,644,477	2.69	416,007	6,620	689	626	583
1944	619,576,240	1,810,900,542	2.92	393,347	6,928	686	624	582

[1] Figures on value and value per ton for years 1890 to 1936, inclusive, and 1939, exclude selling expense. Figures for other years include selling expense.

[2] Data not available.

TABLE 13.—*Growth of the bituminous-coal and lignite-mining industry in the United States, 1890–1944*—Con.

Year	Average number of days worked	Average number of days lost on account of strikes—		Net tons per man—		Percent of underground production—		Percent of total production—	
		Per man employed	Per man on strike	Per day	Per year	Cut by machines [1]	Mechanically loaded	Mechanically cleaned [2]	Mined by stripping
1890	226	(3)	(3)	2.56	579	(3)	(3)	(3)	(3)
1891	223	(3)	(3)	2.57	573	5.3	(3)	(3)	(3)
1892	219	(3)	(3)	2.72	596	(3)	(3)	(3)	(3)
1893	204	(3)	(3)	2.73	557	(3)	(3)	(3)	(3)
1894	171	(3)	(3)	2.84	486	(3)	(3)	(3)	(3)
1895	194	(3)	(3)	2.90	563	(3)	(3)	(3)	(3)
1896	192	(3)	(3)	2.94	564	11.9	(3)	(3)	(3)
1897	196	(3)	(3)	3.04	596	15.3	(3)	(3)	(3)
1898	211	(3)	(3)	3.09	651	19.5	(3)	(3)	(3)
1899	234	8	46	3.05	713	22.7	(3)	(3)	(3)
1900	234	5	43	2.98	697	24.9	(3)	(3)	(3)
1901	225	2	35	2.94	664	25.6	(3)	(3)	(3)
1902	230	7	44	3.06	703	26.8	(3)	(3)	(3)
1903	225	3	28	3.02	680	27.6	(3)	(3)	(3)
1904	202	8	44	3.15	637	28.2	(3)	(3)	(3)
1905	211	2	23	3.24	684	32.8	(3)	(3)	(3)
1906	213	28	63	3.36	717	34.7	(3)	2.7	(3)
1907	234	1	14	3.29	769	35.1	(3)	2.9	(3)
1908	193	11	38	3.34	644	37.0	(3)	3.6	(3)
1909	209	1	29	3.34	699	37.5	(3)	3.8	(3)
1910	217	35	89	3.46	751	41.7	(3)	3.8	(3)
1911	211	2	27	3.50	738	43.9	(3)	(3)	(3)
1912	223	10	35	3.68	820	46.8	(3)	3.9	(3)
1913	232	4	36	3.61	837	50.7	(3)	4.6	(3)
1914	195	19	80	3.71	724	51.8	(3)	4.8	0.3
1915	203	4	61	3.91	794	55.3	(3)	4.7	.6
1916	230	4	26	3.90	896	56.9	(3)	4.6	.8
1917	243	4	17	3.77	915	56.1	(3)	4.6	1.0
1918	249	1	7	3.78	942	56.7	(3)	3.8	1.4
1919	195	25	37	3.84	749	60.0	(3)	3.6	1.2
1920	220	6	22	4.00	881	60.7	(3)	3.3	1.5
1921	149	3	23	4.20	627	66.4	(3)	3.4	1.2
1922	142	78	117	4.28	609	64.8	(3)	(3)	2.4
1923	179	2	20	4.47	801	68.3	0.3	3.8	2.1
1924	171	7	73	4.56	781	71.5	.7	(3)	2.8
1925	195	2	30	4.52	884	72.9	1.2	(3)	3.2
1926	215	1	24	4.50	966	73.8	1.8	(3)	3.0
1927	191	45	153	4.55	872	74.9	(3)	5.3	3.6
1928	203	8	83	4.73	959	76.9	4.5	5.7	4.0
1929	219	(4)	11	4.85	1,064	78.4	7.4	6.9	3.8
1930	187	2	43	5.06	948	81.0	10.5	8.3	4.3
1931	160	3	35	5.30	849	83.2	13.1	9.5	5.0
1932	146	19	120	5.22	762	84.1	12.3	9.8	6.3
1933	167	9	30	4.78	797	84.7	12.0	10.4	5.5
1934	178	3	15	4.40	785	84.1	12.2	11.1	5.8
1935	179	(3)	(3)	4.50	805	84.2	13.5	12.2	6.4
1936	199	2	21	4.62	920	84.8	16.3	13.9	6.4
1937	193	(3)	(3)	4.69	906	(3)	20.2	14.6	7.1
1938	162	1	13	4.89	790	87.5	26.7	18.2	8.7
1939	178	25	36	5.25	936	87.9	31.0	20.1	9.6
1940	202	1	8	5.19	1,049	88.4	35.4	22.2	9.4
1941	216	20	27	5.20	1,125	89.0	40.7	22.9	10.7
1942	246	1	7	5.12	1,261	89.7	45.2	24.4	11.5
1943	264	(3)	(3)	5.38	1,419	90.3	48.9	24.7	13.5
1944	278	(3)	(3)	5.67	1,575	90.5	52.9	25.6	16.3

[1] Percentages for years 1890 to 1913, inclusive, are of total production, as separation of strip-mine and underground production is not available for those years.

[2] For years 1906 to 1926, inclusive, percentages are exclusive of coal cleaned at cental washeries operated by consumers; after 1926, when data became available on tonnage cleaned by consumer-operated plants, percentages include total tons cleaned at mines and at consumer-operated washeries.

[3] Data not available.

[4] One-half day or less.

TABLE 14.—*Coal produced in the United States, by States, 1934–44, with production of maximum year and cumulative production from earliest record to end of 1944, in thousands of net tons*

State	Maximum production		Production by years											Total production from earliest record to end of 1944
	Year	Quantity	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	
Alabama	1926	21,001	9,142	8,505	12,229	12,440	11,062	12,047	15,324	15,464	19,301	17,160	18,752	737,076
Arkansas	1907	2,670	857	1,133	1,623	1,511	1,197	1,152	1,454	1,574	1,985	1,718	1,972	83,396
Colorado	1917	12,483	5,211	5,911	6,812	7,187	5,663	5,923	6,589	6,949	8,086	8,324	8,168	440,961
Georgia	1903	416	33	(1)	(1)	(1)	(1)	(1)	(1)	(1)	31	14	24	(1)
Illinois	1918	89,291	41,272	44,525	50,927	51,602	41,912	46,783	50,610	54,703	65,071	72,631	76,792	2,814,393
Indiana	1918	30,679	14,794	15,754	17,822	17,765	14,759	16,943	18,869	22,484	25,388	25,065	27,962	872,560
Iowa	1917	8,966	3,367	3,650	3,961	3,637	3,103	2,948	3,231	2,939	2,948	2,771	2,141	328,820
Kansas	1918	7,562	2,508	2,686	2,944	2,893	2,654	2,675	3,579	4,008	4,230	3,437	3,369	253,016
Kentucky	1944	71,356	38,525	40,761	47,522	47,086	38,545	42,557	49,141	53,710	62,231	63,211	71,356	1,590,720
Maryland	1907	5,533	1,627	1,678	1,704	1,549	1,281	1,443	1,503	1,701	2,001	1,933	1,870	251,679
Michigan	1907	2,036	622	628	626	562	494	457	410	311	231	169	140	46,128
Missouri	1917	5,671	3,352	3,646	3,985	4,091	3,436	3,273	3,097	3,145	3,520	4,310	4,779	237,846
Montana (bituminous and lignite)	1944	4,844	2,566	2,759	2,988	2,965	2,732	2,804	2,867	3,254	3,829	4,833	4,844	140,231
New Mexico	1918	4,023	1,259	1,389	1,597	1,715	1,239	1,230	1,111	1,251	1,669	1,851	1,744	114,865
North Carolina	1922	79	3	(1)	-----	-----	-----	-----	-----	-----	-----	-----	-----	(1)
North Dakota (lignite)	1942	2,537	1,754	1,956	2,215	2,251	2,050	2,072	2,218	2,309	2,537	2,500	2,366	53,875
Ohio	1920	45,878	20,691	21,153	24,110	25,178	18,591	20,289	22,772	29,319	32,764	32,255	33,877	1,525,414
Oklahoma	1920	4,849	1,208	1,229	1,540	1,600	1,245	1,188	1,646	1,771	2,387	2,838	3,209	143,314
Pennsylvania (bituminous)	1918	178,551	89,826	91,405	109,887	111,002	77,705	92,584	116,603	130,240	144,073	141,050	146,052	6,736,493
Tennessee	1942	8,158	4,136	4,138	5,108	5,213	4,472	5,185	6,008	7,045	8,158	7,179	7,266	295,510
Texas (bituminous and lignite)	1913	2,429	759	758	843	910	879	826	621	353	304	153	[2] 109	60,608
Utah	1944	7,119	2,406	2,947	3,247	3,810	2,947	3,285	3,576	4,077	5.517	6,666	7,119	164,791
Virginia	1943	20,280	9,377	9,667	11,662	13,795	12,283	13,531	15,348	18,441	20,136	20,280	19,514	468,607
Washington	1918	4,082	1,383	1,559	1,812	2,002	1,567	1,690	1.650	1,841	1,953	1,528	1,524	136,864
West Virginia	1944	164,704	98,134	99,179	117.926	118,646	93,288	108,362	126.438	140,250	155,882	158,804	164,704	4,198,059
Wyoming	1920	9,630	4,368	5,177	5,781	5,918	5,204	5,373	5.808	6,646	8,133	9,155	9,540	325,515
Other States	-----	-----	188	180	217	203	237	235	299	364	328	342	383	63,715
Total bituminous and lignite	1944	619,576	359,368	372,373	439,088	445,531	348,545	394,855	460,772	514,149	582,693	590,177	619,576	22,084,456
Pennsylvania anthracite	1917	99,612	57,168	52,159	54,580	51,856	46,099	51,487	51,485	56,368	60,328	60,644	63,701	4,626,470
Grand total	-----	-----	416,536	424,532	493.668	497,387	394,644	446,342	512,257	570,517	643,021	650,821	683,277	26,710,926

1 Included under "Other States."
2 Lignite only.

SUMMARY BY STATES AND DISTRICTS

TABLE 15.—*Number of mines, production, value, employment, days active, man-days, and output per man day at bituminous-coal and lignite mines in the United States, by States, in 1944*

[Exclusive of mines producing less than 1,000 tons]

State	Number of active mines	Disposition of coal produced (net tons)								Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Loaded at mine directly into railroad cars or river barges	Hauled by truck to railroad siding for shipment by rail and to waterway for shipment by water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Taken by locomotive tenders at tipple	Shipped by conveyor or tram to point of consumption	Used by mine employees	Used at mines for power and heat and made into beehive coke at mines [2]	Total quantity		Underground	Surface: In strip pits	Surface: All other	Total			
Alabama	352	15,635,177	1,494,621	952,186	75,964	409,120	95,221	89,876	18,752,165	$3.97	17,399	689	3,605	21,693	285	6,181,211	3.03
Alaska	7	281,550	16,438	27,343	1,215	----	----	21,829	348,375	6.43	260	----	81	341	280	95,544	3.65
Arizona	3	----	----	6,081	----	----	----	----	6,081	2.83	19	----	5	24	116	2,788	2.18
Arkansas	75	1,221,344	689,222	55,292	----	----	3,578	3,005	1,972,441	4.67	1,759	420	456	2,635	212	559,103	3.53
Colorado	170	5,761,812	496,865	1,505,019	15,630	62,073	44,706	[2] 281,608	8,167,713	3.58	5,463	10	1,298	6,771	272	1,841,479	4.44
Georgia	2	16,058	7,000	922	----	----	305	----	24,285	3.81	72	----	12	84	301	25,264	.96
Illinois	325	67,758,436	[1] 1,255,744	6,276,697	24,698	241,977	304,329	929,568	76,791,449	2.23	23,007	1,609	7,367	31,983	263	8,403,246	9.14
Indiana	152	24,523,270	671,083	2,086,357	8,604	494,945	26,505	151,119	27,961,883	2.25	5,573	2,007	2,837	10,417	252	2,630,249	10.63
Iowa	124	629,991	454,472	1,030,501	----	----	18,624	7,348	2,140,936	3.50	2,162	182	378	2,722	205	558,994	3.83
Kansas	63	2,956,247	109,693	244,358	2,000	37,596	8,506	10,687	3,369,087	2.58	611	671	402	1,684	246	414,576	8.13
Kentucky	1,287	60,884,662	4,615,607	5,182,605	16,352	99,588	331,029	[2] 226,154	71,355,997	2.93	42,061	837	8,546	51,444	273	14,051,318	5.08
Maryland	89	1,434,081	131,142	291,564	1,923	----	7,984	3,808	1,870,502	3.43	1,503	104	274	1,881	269	505,051	3.70
Michigan	4	57,779	----	71,137	----	----	2,583	8,439	139,938	5.45	146	----	33	179	278	49,820	2.81
Missouri	114	3,674,740	56,980	1,019,123	----	----	11,617	16,192	4,778,652	2.58	1,249	768	533	2,550	235	599,542	7.97
Montana:																	
Bituminous	32	4,609,220	47,328	118,889	430	----	12,382	4,091	4,792,340	1.91	815	87	346	1,248	279	347,621	13.79
Lignite	14	----	----	[4] 51,709	([4])	----	([4])	----	51,709	2.19	40	7	8	55	173	9,532	5.42
Total Montana	46	4,609,220	47,328	170,598	430	----	12,382	4,091	4,844,049	1.92	855	94	354	1,303	274	357,153	13.56
New Mexico	35	1,571,169	18,572	101,525	----	----	8,572	43,836	1,743,674	3.79	1,351	----	390	1,741	275	479,607	3.64
North Dakota (lignite)	84	1,864,870	----	411,552	----	[4] 59,671	([4])	29,999	2,366,092	1.49	292	254	280	826	213	175,562	13.48
Ohio	553	22,921,399	[1] 5,331,437	5,486,452	972	31,401	54,670	50,724	33,877,055	2.65	13,207	2,237	3,690	19,134	262	5,005,640	6.77
Oklahoma	95	2,463,005	532,023	192,338	----	----	3,818	17,350	3,208,534	3.47	1,625	404	591	2,620	249	652,054	4.92
Oregon	1	----	----	1,453	----	----	----	----	1,453	6.00	8	----	2	10	140	1,400	1.04
Pennsylvania	1,864	102,890,783	[1] 20,946,020	10,846,035	209,635	3,766,391	522,459	[2] 6,871,092	146,052,415	3.15	76,471	6,737	15,067	98,275	281	27,662,630	5.28

South Dakota (lignite)	7	----------	8,920	17,813	(4)	----------	[4] 94	(4)	26,827	2.05	6	20	2	28	177	4,954	5.42
Tennessee	151	6,030,787	[1] 701,516	410,206	42,076	----------	60,728	20,734	7,266,047	3.26	5,674	84	1,092	6,850	264	1,808,955	4.02
Texas (lignite)	3	106,378	----------	1,399	[4] 1,755	----------	----------	(4)	109,532	.87	3	22	11	36	198	7,128	15.37
Utah	49	6,694,954	62,909	305,837	461	----------	23,511	[2] 31,589	7,119,261	3.09	2,787	-------	1,015	3,802	301	1,142,845	6.23
Virginia	138	18,340,070	336,570	289,252	----------	2,548	121,626	[2] 423,808	19,513,874	3.23	13,868	62	2,345	16,275	294	4,778,842	4.08
Washington	49	927,689	103,388	433,257	31,599	----------	11,703	16,505	1,524,141	4.83	1,212	33	380	1,625	293	475,765	3.20
West Virginia	1,031	144,642,686	[1] 13,433,625	2,541,523	369,149	2,001,082	833,268	[2] 882,437	164,703,770	3.01	79,430	3,666	18,822	101,918	288	29,384,512	5.61
Wyoming	55	8,884,757	349,734	164,598	5,216	----------	37,525	98,182	9,540,012	2.69	3,388	125	983	4,496	315	1,418,308	6.73
Grand total	6,928	506,782,914	[1] 51,870,909	40,123,023	807,679	7,206,392	2,545,343	[2] 10,239,980	619,576,240	2.92	301,461	21,035	70,851	393,347	278	109,273,540	5.67

[1] Includes coal hauled by truck to waterway for shipment by water in following States in 1944: Illinois, 111,552 tons; Ohio, 33,398; Pennsylvania, 157,308; Tennessee, 143,264; and West Virginia, 744,689—a grand total of 1,190,211 tons.

[2] Includes coal made into beehive coke at mines in following States in 1944: Colorado, 149,908 tons; Kentucky, 92,764; Pennsylvania, 6,346,659; Utah, 15,0 2; Virginia, 397,105; and West Virginia, 525,389—a grand total of 7,526,907 tons.

[3] Value received or charged for coal f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer, at average prices that might have been received if such coal had been sold commercially.)

[4] As it is necessary to conceal certain items in the lignite break-down of disposition of coal, the figures are shown here in column where greater part of concealed tonnage is included.

TABLE 16.—*Number of mines, production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by districts, in 1944*

[See Mineral Market Report 1359 for additional data by districts. Districts as defined in the Bituminous Coal Act of 1937 and modifications thereto. Exclusive of mines producing less than 1,000 tons]

Minimum price area and producing district	Number of active mines	Disposition of coal produced (net tons): Loaded at mine directly into railroad cars or river barges	Hauled by truck to railroad siding for shipment by rail and to waterway for shipment by water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Taken by locomotive tenders at tipple	Shipped by conveyor or tram to point of consumption	Used by mine employees	Used at mines for power and heat and made into beehive coke at mines [2]	Total quantity	Average value per ton [3]	Average number of employees: Underground	Surface: In strip pits	Surface: All others	Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
PRICE AREA 1																	
District																	
1. Eastern Pennsylvania [4]	1,217	43,144,821	11,452,559	3,488,159	32,711	2,144,738	186,816	[2] 774,482	61,224,286	$3.27	34,186	4,030	7,555	45,771	275	12,587,173	4.86
2. Western Pennsylvania	759	61,941,568	[1] 9,626,580	7,713,556	178,847	1,621,653	348,683	[2] 6,129,647	87,560,534	3.07	44,476	2,811	7,885	55,172	286	15,797,854	5.54
3. Northern West Virginia	403	35,354,155	[1] 10,023,588	806,865	118,460	476,334	82,922	[2] 343,663	47,205,987	2.67	16,699	2,672	4,967	24,338	270	6,580,637	7.17
4. Ohio	553	22,921,399	[1] 5,331,437	5,486,452	972	31,401	54,670	50,724	33,877,055	2.65	13,207	2,237	3,690	19,134	262	5,005,640	6.77
5. Michigan	4	57,779		71,137			2,583	8,439	139,938	5.45	146		33	179	278	49,820	2.81
6. Panhandle	44	2,193,461	[1] 1,084,487	884,517	234,393	995,861	11,072	15,254	5,419,045	2.76	2,517	252	434	3,203	285	912,369	5.94
7. Southern numbered 1	293	59,345,526	1,360,241	359,709	2,692	166,726	450,663	[2] 246,081	61,931,638	3.33	37,435	693	8,139	46,267	297	13,738,287	4.51
8. Southern numbered 2	1,405	115,196,691	[1] 5,084,350	4,024,231	66,076	437,475	754,693	[2] 839,094	126,402,610	3.12	75,254	308	14,943	90,505	284	25,717,884	4.91
Total price area 1	4,678	340,155,400	43,963,242	22,834,626	634,151	5,874,188	1,892,102	8,407,384	423,761,093	3.07	223,920	13,003	47,646	284,569	282	80,389,664	5.27
PRICE AREA 2																	
9. West Kentucky	370	16,127,067	1,131,844	2,072,538	1,800	26,822	28,492	76,898	19,465,461	2.11	6,894	709	1,938	9,541	252	2,401,576	8.11
10. Illinois	325	67,758,436	[1] 1,255,744	6,276,697	24,698	241,977	304,329	929,568	76,791,449	2.23	23,007	1,609	7,367	31,983	263	8,403,246	9.14
11. Indiana	152	24,523,270	671,083	2,086,357	8,604	494,945	26,505	151,119	27,961,883	2.25	5,573	2,007	2,837	10,417	252	2,630,249	10.63
12. Iowa	124	629,991	454,472	1,030,501			18,624	7,348	2,140,936	3.50	2,162	182	378	2,722	205	558,994	3.83
Total price area 2	971	109,038,764	3,513,143	11,466,093	35,102	763,744	377,950	1,164,933	126,359,729	2.24	37,636	4,507	12,520	54,663	256	13,994,065	9.03
PRICE AREA 3																	
13. Southeastern	423	16,571,015	[1] 1,902,452	1,164,718	80,120	409,120	109,279	92,790	20,329,494	3.92	19,017	704	3,902	23,623	282	6,662,003	3.05
PRICE AREA 4																	
14. Arkansas-Oklahoma	111	1,716,079	744,883	75,281			5,319	5,897	2,547,459	4.60	2,483	440	664	3,587	216	775,836	3.28

PRICE AREA 5																	
15. Southwestern:																	
Bituminous	236	8,599,257	643,035	1,435,830	2,000	37,596	22,200	41,337	10,781,255	2.75	2,761	1,823	1,318	5,902	246	1,449,439	7.44
Lignite (Texas)	3	106,378		1,399	[5] 1,755			([5])	109,532	.87	3	22	11	36	198	7,128	15.37
Total price area 5	239	8,705,635	643,035	1,437,229	3,755	37,596	22,200	41,337	10,890,787	2.73	2,764	1,845	1,329	5,938	245	1,456,567	7.48
PRICE AREA 6																	
16. Northern Colorado	35	1,567,206	30,288	797,228		21,222	18,255	45,234	2,479,433	3.36	1,574	7	332	1,913	240	458,194	5.41
17. Southern Colorado [6]	140	5,310,254	466,577	715,552	15,630	40,851	31,578	[2] 239,644	6,820,086	3.63	4,500	3	1,127	5,630	286	1,611,206	4.23
18. New Mexico [7]	33	455,521	18,572	99,845			3,445	40,566	617,949	4.55	759		234	993	256	254,474	2.43
Total price area 6	208	7,332,981	515,437	1,612,625	15,630	62,073	53,278	325,444	9,917,468	3.62	6,833	10	1,693	8,536	272	2,323,874	4.27
PRICE AREA 7																	
19. Wyoming [8]	55	8,884,757	349,734	164,598	5,216		37,525	98,182	9,540,012	2.69	3,388	125	983	4,496	315	1,418,308	6.73
20. Utah	49	6,694,954	62,909	305,837	461		23,511	[2] 31,589	7,119,261	3.09	2,787		1,015	3,802	301	1,142,845	6.23
Total price area 7	104	15,579,711	412,643	470,435	5,677		61,036	129,771	16,659,273	2.86	6,175	125	1,998	8,298	309	2,561,153	6.50
PRICE AREA 8																	
21. North-South Dakota (lignite)	91	1,864,870	8,920	429,365	([5])	[5] 59,671	[5] 94	29,999	2,392,919	1.50	298	274	282	854	211	180,516	13.26
PRICE AREA 9																	
22. Montana (bituminous and lignite)	46	4,609,220	47,328	[5] 170,598	[5] 430		[5] 12,382	4,091	4,844,049	1.92	855	94	354	1,303	274	357,153	13.56
PRICE AREA 10																	
23. Washington [9]	50	927,689	103,388	434,710	31,599		11,703	16,505	1,525,594	4.83	1,220	33	382	1,635	292	477,165	3.20
Alaska	7	281,550	16,438	27,343	1,215			21,829	348,375	6.43	260		81	341	280	95,544	3.65
Total price area 10	57	1,209,239	119,826	462,053	32,814		11,703	38,334	1,873,969	5.23	1,480	33	463	1,976	290	572,709	3.27
Grand total [10]	6,928	506,782,914	[1] 51,870,909	40,123,023	807,679	7,206,392	2,545,343	[2] 10,239,980	619,576,240	2.92	301,461	21,035	70,851	393,347	278	109,273,540	5.67

[1] Includes coal hauled by truck to waterway for shipment by water in following districts in 1944: District 2, 157,308 tons; district 3, 488,679; district 4, 33,398; district 6, 93,672 district 8, 162,338; district 10, 111,552; and district 13, 143,264—a grand total of 1,190,211 tons.

[2] Includes coal made into beehive coke at mines in following districts in 1944: District 1, 332,073 tons; district 2, 6,014,586; district 3, 280,542; district 7, 66,391; district 8, 668,325; district 17, 149,908; and district 20, 15,082—a grand total of 7,526,907 tons.

[3] Value received or charged for coal f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

[4] Includes Maryland and Grant, Mineral, and Tucker Counties, West Virginia.

[5] As it is necessary to conceal certain items in the lignite break-down of disposition of coal, the figures are shown here in column where greater part of concealed tonnage is included.

[6] Includes Colfax County, New Mexico.

[7] Includes Arizona and California, but excludes Colfax County, N. Mex. No production was reported for California.

[8] Includes Idaho. No production was reported for Idaho.

[9] Includes Oregon.

[10] For purposes of historical comparison and statistical convenience, figures include output of lignite and of anthracite and semianthracite outside of Pennsylvania.

PRODUCTION BY WEEKS AND MONTHS

TABLE 17.—*Bituminous-coal and lignite production (final figures) in the United States in 1944, with estimates by weeks*

Weed ended—	Production (net tons)	Number of working days	Average production per working day (net tons)	Week ended—	Production (net tons)	Number of working days	Average production per working day (net tons)
Jan. 1	[1] 1,230,000	[1] 0.7	[2] 1,845,000	July 15	12,293,000	6	2,049,000
8	12,302,000	6	2,050,000	22	11,974,000	6	1,996,000
15	12,843,000	6	2,141,000	29	12,377,000	6	2,063,000
22	12,722,000	6	2,120,000	Aug. 5	11,944,000	6	1,991,000
29	12,916,000	6	2,153,000	12	12,148,000	6	2,025,000
Feb. 5	12,902,000	6	2,150,000	19	11,923,000	6	1,987,000
12	12,981,000	6	2,164,000	26	12,070,000	6	2,012,000
19	12,404,000	6	2,067,000	Sept. 2	11,676,000	6	1,946,000
26	12,605,000	6	2,101,000	9	10,978,000	5.4	2,033,000
Mar. 4	12,114,000	6	2,019,000	16	11,671,000	6	1,945,000
11	12,308,000	6	2,051,000	23	11,951,000	6	1,992,000
18	12,078,000	6	2,013,000	30	12,164,000	6	2,027,000
25	11,958,000	6	1,993,000	Oct. 7	11,702,000	6	1,950,000
Apr. 1	11,735,000	5.6	2,096,000	14	11,910,000	6	1,985,000
8	12,053,000	6	2,009,000	21	11,818,000	6	1,970,000
15	11,730,000	6	1,955,000	28	12,183,000	6	2,031,000
22	12,230,000	6	2,038,000	Nov. 4	12,000,000	6	2,000,000
29	12,357,000	6	2,060,000	11	10,790,000	5.5	1,962,000
May 6	11,844,000	6	1,974,000	18	12,284,000	6	2,047,000
13	12,242,000	6	2,040,000	25	11,410,000	5.6	2,038,000
20	12,004,000	6	2,001,000	Dec. 2	12,010,000	5.9	2,036,000
27	12,282,000	6	2,047,000	9	12,192,000	6	2,032,000
June 3	11,637,000	5.7	2,042,000	16	10,217,000	6	1,703,000
10	12,327,000	6	2,055,000	23	11,128,000	6	1,855,000
17	12,148,000	6	2,025,000	30	8,433,000	5	1,687,000
24	11,845,000	6	1,974,000				
July 1	11,865,000	6	1,978,000		619,576,000	308.4	2,009,000
8	8,668,000	5	1,734,000				

[1] Figures represent output and number of working days in that part of week included in calendar year shown. Total production for week ended Jan. 1, 1944, was 10,515,000 net tons.
[2] Average daily production for entire week and not for working days in calendar year shown.

TABLE 18.—*Coal production in the United States, in 1944, by States (final figures), with estimates by months, in thousands of net tons*

[Totals for year are based on final complete returns from all operators known to have produced more than 1,000 tons a year. Apportionment of known yearly total among the 12 months is based upon best information available; in some States upon direct tonnage reports by operators to State mine departments; in most cases upon current records of railway carloadings and waterway shipments]

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama	1,662	1,580	1,674	1,474	1,612	1,533	1,476	1,636	1,552	1,555	1,598	1,400	18,752
Alaska	31	33	38	25	27	29	28	23	25	31	32	27	349
Arkansas	187	179	186	159	180	163	155	169	155	158	152	129	1,972
Colorado	870	815	811	654	601	559	512	638	639	682	667	720	8,168
Georgia	2	2	2	1	2	2	2	2	2	2	3	2	24
Illinois	7,063	6,806	6,981	6,150	6,461	6,426	5,847	6,485	5,798	6,305	6,144	6,326	76,792
Indiana	2,552	2,378	2,486	2,120	2,291	2,319	2,244	2,398	2,239	2,183	2,328	2,424	27,962
Iowa	225	210	200	150	131	159	153	160	180	188	190	195	2,141
Kansas	306	303	310	258	298	269	257	286	278	268	272	264	3,369
Kentucky:													
Eastern	4,473	4,344	4,560	4,140	4,590	4,361	4,078	4,651	4,245	4,390	4,259	3,800	51,891
Western	1,560	1,552	1,552	1,560	1,767	1,756	1,708	1,643	1,608	1,688	1,593	1,478	19,465
Total, Kentucky	6,033	5,896	6,112	5,700	6,357	6,117	5,786	6,294	5,853	6,078	5,852	5,278	71,356
Maryland	171	172	171	153	162	167	156	172	146	150	135	115	1.870
Michigan	13	13	14	12	11	11	9	11	11	12	11	12	140
Missouri	434	430	439	366	423	382	364	405	395	380	386	375	4,779
Montana:													
Bituminous	418	403	408	379	344	357	315	412	412	456	418	470	4,792
Lignite	5	4	5	4	4	4	3	4	4	5	5	5	52
Total, Montana	423	407	413	383	348	361	318	416	416	461	423	475	4,844
New Mexico	160	148	172	148	160	139	127	148	134	137	140	131	1,744
North Dakota (lignite)	307	218	211	120	120	132	141	166	179	254	248	270	2,366
Ohio	2,795	2,775	2,852	2,723	3,082	3,064	2,752	3,030	2,818	2,854	2,840	2,292	33,877
Oklahoma	286	281	251	227	253	247	241	272	295	316	279	261	3,209
Pennsylvania (bituminous)	12,448	12,565	12,986	11,800	13,112	12,643	11,768	12,570	12,102	12,145	11,733	10,180	146,052
South Dakota (lignite)	3	2	2	1	2	2	2	2	2	3	3	3	27
Tennessee	660	634	686	591	627	611	577	604	586	590	588	512	7,266
Texas (lignite)	13	12	12	9	8	6	6	8	7	8	8	12	109
Utah	663	654	650	600	615	580	516	582	544	545	590	580	7 119
Virginia	1,780	1,676	1,754	1,556	1,722	1,632	1,497	1,705	1,554	1,660	1,639	1,339	19,514
Washington	141	134	129	116	131	134	110	137	118	126	119	129	1,524
West Virginia	14,029	13,662	14,490	13,341	14,386	14,219	13,306	15,073	13,612	13,783	13,453	11,350	164,704
Wyoming	884	848	871	751	772	699	624	758	767	823	880	863	9,540
Other States [1]	1	(2)	(2)	2	(2)	(2)	(2)	(2)	1	1	1	1	7
Total, bituminous and lignite	54,142	52,833	54,903	49,590	53,894	52,605	48,974	54,150	50,408	51,698	50,714	45,665	619,576
Pennsylvania anthracite [3]	4.970	5,811	5,512	5.141	5,781	5,558	4,905	5,558	5,380	5,538	5,029	4,518	63,701
Grand total	59,112	58,644	60,415	54,731	59,675	58,163	53,879	59,708	55,788	57,236	55,743	50,183	683,277

[1] Includes Arizona and Oregon. [2] Less than 500 tons.
[3] Includes Sullivan County, washery and dredge coal, local sales, colliery fuel, and coal shipped by truck from authorized operations; also includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

TABLE 19.—*Number and production of bituminous-coal and lignite mines in the United States, classified by size of output in each State, in 1944*

[Exclusive of mines producing less than 1,000 tons]

State	Class 1A—More than 500,000 tons					Class 1B—200,000 to 500,000 tons					Class 2—100,000 to 200,000 tons				
	Mines		Production			Mines		Production			Mines		Production		
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent
Alabama	7	2.0	4, 813, 724	687, 675	25.7	20	5.7	6, 534, 416	326, 721	34.9	26	7.4	3, 813, 821	146, 685	20.3
Alaska											2	28.6	232, 059	116, 030	66.6
Arizona															
Arkansas											4	5.3	469, 100	117, 275	23.8
Colorado	1	.6	619, 847	619, 847	7.6	7	4.1	1, 789, 378	255, 625	21.9	21	12.4	3, 062, 284	145, 823	37.5
Georgia															
Illinois	55	16.9	60, 459, 022	1, 099, 255	78.7	24	7.4	8, 085, 063	336, 878	10.5	21	6.5	2, 976, 414	141, 734	3.9
Indiana	19	12.5	17, 290, 334	910, 018	61.8	21	13.8	6, 749, 185	321, 390	24.1	14	9.2	1, 958, 910	139, 922	7.0
Iowa						1	.8	224, 759	224, 759	10.5	2	1.6	268, 320	134, 160	12.5
Kansas	1	1.6	705, 987	705, 987	20.9	5	7.9	1, 717, 291	343, 458	51.0	2	3.2	313, 079	156, 540	9.3
Kentucky	26	2.0	22, 194, 209	853, 623	31.1	81	6.3	23, 741, 257	293, 102	33.3	81	6.3	12, 194, 046	150, 544	17.1
Maryland						2	2.2	496, 856	248, 428	26.6	2	2.2	269, 514	134, 757	14.4
Michigan															
Missouri	3	2.6	1, 673, 521	557, 840	35.0	5	4.4	1, 747, 822	349, 564	36.6	3	2.6	363, 059	121, 020	7.6
Montana (bituminous)	2	6.3	3, 044, 564	1, 522, 282	63.5	4	12.5	1, 410, 920	352, 730	29.5	1	3.1	150, 694	150, 694	3.1
Montana, North Dakota, South Dakota, and Texas (lignite)						6	5.5	1, 958, 702	326, 450	76.7	1	.9	104, 525	104, 525	4.1
New Mexico						4	11.4	1, 227, 374	306, 844	70.4	2	5.7	282, 908	141, 454	16.2
Ohio	20	3.6	16, 613. 498	830, 675	49.0	20	3.6	6, 201, 587	310, 079	18.3	31	5.6	4, 308, 698	138, 990	12.7
Oklahoma						3	3.2	925, 067	308, 356	28.8	8	8.4	1, 089, 786	136, 223	34.0
Oregon															
Pennsylvania	72	3.9	67, 903, 898	943, 110	46.5	96	5.2	30, 742, 716	320, 237	21.0	131	7.0	18, 423, 475	140, 637	12.6
Tennessee						12	7.9	3, 608, 711	300, 726	49.7	12	7.9	1, 545, 013	128, 751	21.3
Utah	5	10.2	4, 097, 237	819, 447	57,6	6	12.2	2, 018, 280	336, 380	28.3	4	8.2	517, 515	129, 379	7.3
Virginia	10	7.3	8, 636, 980	863, 698	44.3	17	12.3	6, 048, 357	355, 786	31.0	22	15.9	3, 217, 730	146, 260	16.5
Washington						1	2.0	231, 882	231, 882	15.2	4	8.2	565, 563	141, 391	37.1
West Virginia	83	8.0	68, 654, 348	827. 161	41.7	178	17.3	57, 771, 053	324, 556	35.1	154	14.9	22, 896, 212	148, 677	13.9
Wyoming	6	10.9	5, 722, 418	953, 736	60.0	5	9.1	1, 920, 608	384, 122	20.1	11	20.0	1, 355, 656	123, 241	14.2
Total	310	4.5	282, 429, 587	911, 063	45.6	518	7.5	165, 151, 284	318, 825	26.6	559	8.1	80, 378, 381	143, 790	13.0

State	Class 3—50,000 to 100,000 tons					Class 4—10,000 to 50,000 tons					Class 5—less than 10,000 tons					Total		
	Mines		Production			Mines		Production			Mines		Production			Mines	Production (net tons)	
	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent	Number	Percent	Total (net tons)	Average per mine (net tons)	Percent		Total	Average per mine
Alabama	24	6.8	1,560,571	65,024	8.3	54	15.3	1,271,321	23,543	6.8	221	62.8	758,312	3,431	4.0	352	18,752,165	53,273
Alaska	1	14.2	68,407	68,407	19.7	2	28.6	39,455	19,728	11.3	2	28.6	8,454	4,227	2.4	7	348,375	49,768
Arizona											3	100.0	6,081	2,027	100.0	3	6,081	2,027
Arkansas	10	13.3	713,841	71,384	36.2	27	36.0	654,375	24,236	33.2	34	45.4	135,125	3,974	6.8	75	1,972,441	26,299
Colorado	20	11.8	1,449,583	72,479	17.7	40	23.5	936,213	23,405	11.5	81	47.6	310,408	3,832	3.8	170	8,167,713	48,045
Georgia						1	50.0	16,363	16,363	67.4	1	50.0	7,922	7,922	32.6	2	24,285	12,143
Illinois	33	10.1	2,324,086	70,427	3.0	94	28.9	2,512,764	26,732	3.3	98	30.2	434,100	4,430	.6	325	76,791,449	236,281
Indiana	14	9.2	973,440	69,531	3.5	30	19.8	769,205	25,640	2.8	54	35.5	220,809	4,089	.8	152	27,961,883	183,960
Iowa	9	7.3	616,975	68,553	28.8	37	29.8	714,414	19,308	33.4	75	60.5	316,468	4,220	14.8	124	2,140,936	17,266
Kansas	2	3.2	134,532	67,266	4.0	13	20.6	337,027	25,925	10.0	40	63.5	161,171	4,029	4.8	63	3,369,087	53,478
Kentucky	58	4.5	4,011,373	69,162	5.6	303	23.6	6,487,596	21,411	9.1	738	57.3	2,727,516	3,696	3.8	1,287	71,355,997	55,444
Maryland	7	7.9	448,595	64,085	24.0	17	19.1	456,547	26,856	24.4	61	68.6	198,990	3,262	10.6	89	1,870,502	21,017
Michigan	1	25.0	99,175	99,175	70.9	2	50.0	34,938	17,469	25.0	1	25.0	5,825	5,825	4.1	4	139,938	34,985
Missouri	2	1.8	110,879	55,440	2.3	31	27.2	643,508	20,758	13.5	70	61.4	239,863	3,427	5.0	114	4,778,652	41,918
Montana (bituminous)	1	3.1	51,514	51,514	1.1	2	6.3	62,053	31,027	1.3	22	68.7	72,595	3,300	1.5	32	4,792,340	149,761
Montana, North Dakota, South Dakota, and Texas (lignite)	2	1.9	161,167	80,584	6.3	10	9.3	193,718	19,372	7.6	89	82.4	136,048	1,529	5.3	108	2,554,160	23,650
New Mexico						6	17.2	158,042	26,340	9.1	23	65.7	75,350	3,276	4.3	35	1,743,674	49,819
Ohio	35	6.3	2,382,467	68,070	7.0	149	27.0	3,340,974	22,423	9.9	298	53.9	1,029,831	3,456	3.1	553	33,877,055	61,260
Oklahoma	7	7.4	549,385	78,484	17.1	19	20.0	417,943	21,997	13.0	58	61.0	226,353	3,903	7.1	95	3,208,534	33,774
Oregon											1	100.0	1,453	1,453	100.0	1	1,453	1,453
Pennsylvania	170	9.1	11,794,385	69,379	8.1	599	32.1	13,818,186	23,069	9.5	796	42.7	3,369,755	4,233	2.3	1,864	146,052,415	78,354
Tennessee	12	8.0	842,730	70,228	11.6	46	30.5	978,375	21,269	13.4	69	45.7	291,218	4,221	4.0	151	7,266,047	48,120
Utah	3	6.1	188,446	62,815	2.6	10	20.4	233,008	23,301	3.3	21	42.9	64,775	3,085	.9	49	7,119,261	145,291
Virginia	12	8.7	914,366	76,197	4.7	23	16.7	492,645	21,419	2.5	54	39.1	203,796	3,774	1.0	138	19,513,874	141,405
Washington	4	8.2	292,240	73,060	19.2	15	30.6	343,126	22,875	22.5	25	51.0	91,330	3,653	6.0	49	1,524,141	31,105
West Virginia	105	10.2	7,870,526	74,957	4.8	243	23.6	6,409,222	26,375	3.9	268	26.0	1,102,409	4,113	.6	1,031	164,703,770	160,062
Wyoming	8	14.5	393,200	49,150	4.1	3	5.5	73,876	24,625	.8	22	40.0	74,254	3,375	.8	55	9,540,012	173,455
Total	540	7.8	37,951,883	70,281	6.1	1,776	25.6	41,394,894	23,308	6.7	3,225	46.5	12,270,211	3,805	2.0	6,928	619,576,240	89,431

AVERAGE VALUE

Before the Bituminous Coal Act of 1937 was passed, the most valuable single index of the trend of prices at the mines was the "average value per ton, f.o.b. mines," as given in the familiar annual coal reports of the Bureau of Mines, United States Department of the Interior. This series was referred to in Bureau of Mines reports as representing "bituminous coal," and it covered all coal (other than Pennsylvania anthracite) produced in the United States. It represented the bituminous-coal industry as the term ordinarily was used in the trade and included the lignite of the Dakotas, Texas, and Montana, as well as any small tonnages of hard coal produced outside of Pennsylvania.

With the passage of the Coal Act, the Bureau of Mines relinquished the collection of statistics relating to bituminous coal, effective June 30, 1937, though continuing to compile data regarding lignite and Pennsylvania anthracite. Effective the same date, the Coal Commission became responsible for the compilation of data on bituminous coal, though not attempting to collect data regarding lignite, which was specifically exempted by the act. The records of the Commission (later the Bituminous Coal Division, United States Department of the Interior) relate to all coal other than Pennsylvania anthracite, Virginia semianthracite, and lignite.

To permit comparison of the old and new series, therefore, it is necessary to separate the lignites from the bituminous coals, though the combined average for the two is continued in a form as nearly comparable as possible to the old series (see table 20).

TABLE 20.—*Trend of average value in the United States of bituminous coal and lignite per ton, f. o. b. mines, 1929–44*

Year	Bituminous coal (subject to regulation under 1937 act) [1]	Lignite [2]	Total
Average value per ton less selling cost:			
1929	$1.782	$1.548	$1.781
1930	1.702	1.556	1.701
1931	1.542	1.410	1.541
1932	1.313	1.313	1.313
1933	1.337	1.188	1.336
1934	1.751	1.387	1.749
1935	1.772	1.120	1.767
1936	1.761	1.061	1.756
Average gross realization, selling cost not deducted:			
1936	1.831	[3] 1.061	1.826
1937	1.946	[3] 1.080	1.939
1938	1.955	[3] 1.071	1.947
1939 [4]	1.850	1.158	1.845
1940	1.913	[3] 1.156	1.908
1941	2.194	1.237	2.189
1942	2.363	1.364	2.358
1943	2.691	1.490	2.685
1944	2.929	1.487	2.923

[1] Includes all coal produced other than Pennsylvania anthracite and lignite included in second column.
[2] North Dakota, South Dakota, and lignite counties of Montana and Texas.
[3] Figures for 1936–38 and 1940 exclude selling cost as before.
[4] Producers were asked to exclude selling cost in reporting value, but a number of them included such costs.

A more important change in the two series relates to the treatment of selling expenses. The old Bureau of Mines series of "value at the mines" excluded the selling cost. Reporting operators were asked to state the "Amount received at the mines f. o. b. cars less the selling expense." No details were asked regarding the items included in the value, and no systematic effort was made to follow up the exclusion of selling expenses. It was realized at the time that some producers might find it impractical to exclude selling costs and that some part of the selling expenses of the industry might be included in the results. Nevertheless, the reports were checked for consistency from year to year, the questions were retained in the same form without change, and the results are believed to have been comparable from one year to the next. The new series of the Coal Commission represents the total or gross realization on all coal produced and specifically includes the selling cost.

The two sets of data may not be precisely comparable with respect to coal produced but not sold on the commercial market. In the Bureau of Mines series reporting operators were instructed that the "value of coal not sold but used by producer, also mine fuel and coal made into coke, should be estimated at average prices that might have been received." The instructions of the Coal Commission regarding such items were in effect similar, though given in greater detail.

A comparison of the two series is possible for 1936. In that year the average value per ton on the old (Bureau of Mines) basis amounted to $1.761 per ton for bituminous coal, excluding lignite. The average gross realization, according to data collected by the Coal Commission, was $1.831 per ton. The difference amounts to $0.07 per ton—an amount somewhat less than the average selling expenditure computed per ton of all coal produced, as reported to the Coal Commission. The comparison confirms previous indications that the great majority of operators reporting in earlier years had followed instructions and omitted selling expenses in computing the average value but that some of them had included the selling expense. The change in method of reporting should be kept in mind in comparing the two sets of data. As the reports to the Commission were submitted on a detailed accounting return and made under oath, they are to be accepted. The returns of earlier years, upon a voluntary basis and not in all instances uniform as to treatment of selling costs, seems to have been thoroughly comparable from one year to the next and afford the best available index to the rise and fall of the mine prices received by operators down to 1936.

LABOR STATISTICS

Men employed.—An average of 393,347 men was employed at bituminous-coal mines in 1944, a 5.5 percent decrease from the total of 416,007 for 1943 (see fig. 10).

The method used here in calculating employment gives an accurate measure of the working force in the coal industry, but it does not consider the time lost by men on the rolls through intermittent operations. To measure the influence of intermittency upon employment the factor of mine activity as indicated by the average number of days of plant operation was recorded separately. The average number of men on the rolls when the mines were in operation was then used, in conjunction with the average number of days of operation, as a measure of the total volume of employment in the industry.

Days operated.—The average number of days of operation at bituminous-coal mines in 1944 was 278. This represents an increase over the average of 264 days for 1943. All statistics on days of mine operation included in this report are weighted averages, in which the operating time of each mine has been weighted by the number of its employees. Several coal-mining States publish series on the number of days worked that are simple averages of the figures for each reporting mine, regardless of size. As these unweighted averages are likely to be unduly depressed by small mines, which generally operate fewer days than the larger ones, they tend to understate the working time of a typical mine employee.

Man-days of labor.—Man-days have been computed by multiplying the number of workers employed by the number of operating days. Although these computations were made for each individual mine, the combined total is necessarily only an approximation.

Data for 1944 indicate that bituminous-coal-mine employees performed 109,273,540 man-days of labor during the year. Table 15 gives a summary record of men employed, days operated, and output per man per day at bituminous-coal mines, by States, in 1944. Details by counties for 1944 are shown in table 41.

Length of working days.—Table 21 summarizes the replies of mine operators to the question, "Number of hours operated per shift."

TABLE 21.—*Number of bituminous-coal and lignite mines in the United States having established working shift of certain length and number of men employed therein in 1944*

State	7 hours		8 hours		9 hours		All others [1]		Total	
	Mines	Men	Mines	Men	Mines	Men	Mines	Men	Mines	Men
Alabama	64	1,004	270	19,597	10	556	8	536	352	21,693
Alaska			7	341					7	341
Arizona			3	24					3	24
Arkansas	1	13	65	2,354	5	172	4	96	75	2,635
Colorado	25	183	132	6,315	2	155	11	118	170	6,771
Georgia			2	84					2	84
Illinois	161	17,712	145	13,222			19	1,049	325	31,983
Indiana	34	1,637	110	8,373	1	7	7	400	152	10,417
Iowa	28	406	81	2,135	7	34	8	147	124	2,722
Kansas	11	145	45	1,276	1	12	6	251	63	1,684
Kentucky:										
Eastern	16	889	888	40,352	8	357	5	305	917	41,903
Western	65	928	297	8,088	1	210	7	315	370	9,541
Total Kentucky	81	1,817	1,185	48,440	9	567	12	620	1,287	51,444
Maryland	15	123	71	1,716	2	38	1	4	89	1,881
Michigan	2	66	2	113					4	179
Missouri	11	182	90	2,133	8	53	5	182	114	2,550
Montana:										
Bituminous	4	19	27	1,223			1	6	32	1,248
Lignite	1	7	11	44			2	4	14	55
Total Montana	5	26	38	1,267			3	10	46	1,303
New Mexico	3	26	30	1,690			2	25	35	1,741
North Dakota (lignite)	9	56	40	465	4	18	31	287	84	826
Ohio	108	1,623	385	15,782	9	80	51	1,649	553	19,134
Oklahoma	9	80	74	2,220	6	171	6	149	95	2,620
Oregon			1	10					1	10
Pennsylvania	427	9,820	1,237	82,192	33	485	167	5,778	1,864	98,275
South Dakota (lignite)			5	23	1	1	1	4	7	28
Tennessee	54	740	95	6,074	2	36			151	6,850
Texas (lignite)			2	35			1	1	3	36
Utah	7	87	37	3,474	1	26	4	215	49	3,802
Virginia	13	446	121	15,167	2	17	2	645	138	16,275
Washington	9	165	37	1,420	1	19	2	21	49	1,625
West Virginia	121	3,988	845	93,956	17	1,399	48	2,575	1,031	101,918
Wyoming	8	87	44	4,284	1	45	2	80	55	4,496
Total	1,206	40,432	5,199	334,182	122	3,891	401	14,842	6,928	393,347

[1] Includes mines where the day was more than 9 or less than 7 hours or was irregular.

The established working day does not of itself measure the length of time that men actually work or the time that they are underground, because of the possibility of overtime, because the mine may sometimes shut down before the full day is over, because the miner may go home before the mine stops, and because he spends a considerable time going to and from his place of work underground. These figures represent the operator's statement of the nominal operating day for the mine. They do not purport to represent the time actually worked by the men. On the one hand, they make no allowance for tonnage or piece workers who leave early; on the other hand, they make no allowance for tonnage men who continue at work after the mine as a whole is shut down or who go into the mine to work on days when the tipple is idle.

It was found that 85 percent of the men employed were in 8-hour mines and that the weighted average working shift was 7.9 hours.

BITUMINOUS COAL AND LIGNITE LOADED FOR SHIPMENT BY INDIVIDUAL RAILROADS AND WATERWAYS

TABLE 22.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1944* [1]

Route	State	Net tons	
		By State	Total for route
RAILROADS			
Alabama Central	Alabama	192,992	192,992
Alabama Great Southern	do	218,758	218,758
Alaska	Alaska	297,988	297,988
Algiers, Winslow & Western	Indiana	2,949,372	2,949,372
Alton	Illinois	1,106,854	1,106,854
Artemus-Jellico	Kentucky	527,224	527,224
Atchison, Topeka & Santa Fe	Colorado	401,228	2,865,256
	Illinois	830,007	
	Kansas	417,269	
	Missouri	5,942	
	New Mexico	1,210,810	
Baltimore & Ohio	Illinois	422,036	52,222,614
	Indiana	856,938	
	Maryland	25,195	
	Ohio	5,619,218	
	Pennsylvania	14,928,859	
	West Virginia	30,370,368	
Bessemer & Lake Erie	Pennsylvania	3,846,647	3,846,647
Bevier & Southern	Missouri	579,232	579,232
Brimstone	Tennessee	57,670	57,670
Buffalo Creek & Gauley	West Virginia	798,051	798,051
Cambria & Indiana	Pennsylvania	4,631,508	4,631,508
Campbell's Creek	West Virginia	921,456	921,456
Carbon County	Utah	1,690,430	1,690,430
Caseyville	Illinois	31,221	31,221
Central of Georgia	Alabama	769,066	792,124
	Georgia	23,058	
Chesapeake & Ohio	Kentucky	13,095,357	65,404,951
	Ohio	1,095,175	
	West Virginia	51,214,419	
Cheswick & Harmar	Pennsylvania	1,047,007	1,047,007
Chicago, Attica & Southern	Indiana	2,184	2,184
Chicago, Burlington & Quincy	Colorado	418,699	14,508,696
	Illinois	12,373,809	
	Iowa	246,698	
	Missouri	52,446	
	Wyoming	1,417,044	
Chicago & Eastern Illinois	Illinois	3,439,059	5,657,912
	Indiana	2,218,853	
Chicago & Illinois Midland	Illinois	6,222,130	6,222,130

See footnotes at end of table.

TABLE 22.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1944* [1]—Con.

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS—continued			
Chicago, Indianapolis & Louisville	Indiana	1,314,430	1,314,430
Chicago, Milwaukee, St. Paul & Pacific	do	7,072,462	8,585,954
	Iowa	347,133	
	Missouri	11,643	
	Montana (bituminous)	1,096,038	
	North Dakota (lignite) South Dakota (lignite)	52,927	
	Washington	5,751	
Chicago & North Western	Illinois	3,292,420	3,292,420
Chicago, Rock Island & Pacific	Arkansas	50,001	1,114,060
	Illinois	565,893	
	Iowa	72,386	
	Missouri	280,331	
	Oklahoma	145,449	
Cleveland, Cincinnati, Chicago, & St. Louis	Illinois	4,635,109	7,712,276
	Indiana	3,077,167	
Clinchfield	Kentucky	118,255	3,067,460
	Virginia	2,949,205	
Colorado & Southeastern	Colorado	169,051	169,051
Colorado & Southern	do	675,371	675,371
Colorado & Wyoming	do	616,698	616,698
Conemaugh & Black Lick	Pennsylvania	62,628	62,628
Cumberland & Pennsylvania	Maryland	494,580	494,580
Dardanelle & Russellville Ry. Co	Arkansas	44,195	44,195
Denver & Intermountain	Colorado	107,064	107,064
Denver & Rio Grande Western	do	1,753,511	5,463,201
	New Mexico	16,771	
	Utah	3,692,919	
Denver & Salt Lake	Colorado	1,202,841	1,202,841
Detroit, Toledo & Ironton	Ohio	14,110	14,110
East Broad Top Railroad & Coal Co	Pennsylvania	363,861	363,861
Erie	Ohio	75,383	1,091,759
	Pennsylvania	1,016,376	
Evansville & Ohio Valley	Indiana	20,649	20,649
Evansville, Suburban & Newburgh	do	258,128	258,128
Fort Dodge, Des Moines & Southern	Iowa	51,311	51,311
Fort Smith, Subiaco & Rock Island	Arkansas	14,990	14,990
Fort Smith & Van Buren	Oklahoma	227,235	227,235
Galesburg & Great Eastern	Illinois	702,672	702,672
Great Northern [2]	Montana (bituminous)	452,188	1,742,069
	North Dakota (lignite) [2]	1,191,682	
	Washington	98,199	
Gulf, Mobile & Ohio	Alabama	241,278	1,707,084
	Illinois	1,465,806	
Harriman & Northeastern	Tennessee	84,151	84,151
Huntingdon & Broad Top Mountain Railroad & Coal Co.	Pennsylvania	618,071	618,071
Illinois Central	Alabama	213,765	26,608,074
	Illinois	16,325,138	
	Indiana	141,508	
	Kentucky	9,927,663	
Illinois Terminal	Illinois	478,878	478,878
Interstate	Kentucky	142,960	3,112,304
	Virginia	2,969,344	
Iowa Southern Utilities Co	Iowa	106,159	106,159
Johnstown & Stony Creek	Pennsylvania	233,242	233,242
Joplin-Pittsburg	Kansas	367,615	367,615
Kanawha Central	West Virginia	123,333	123,333
Kansas City Southern	Missouri	557,491	620,230
	Oklahoma	62,739	
Kansas, Oklahoma & Gulf	do	9,297	9,297
Kelley's Creek & Northwestern	West Virginia	1,811,961	1,811,961
Kentucky & Tennessee	Kentucky	949,838	949,838
Lake Erie, Franklin & Clarion	Pennsylvania	507,915	507,915
Laramie, North Park & Western	Colorado	11,026	11,026
Ligonier Valley	Pennsylvania	145,762	145,762
Litchfield & Madison	Illinois	775,030	775,030
Louisville & Nashville	Alabama	3,281,914	37,339,656
	Illinois	12,966	
	Kentucky	32,731,115	
	Tennessee	1,079,470	
	Virginia	234,191	

See footnotes at end of table.

TABLE 22.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1944* [1]—Con.

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS—continued			
Mary Lee	Alabama	883, 558	883, 558
Midland Valley	Arkansas	397, 719	749, 848
	Oklahoma	352, 129	
Minneapolis & St. Louis	Illinois	2, 712, 866	2, 789, 653
	Iowa	76, 787	
Minneapolis, St. Paul & Sault Ste. Marie [2]	North Dakota (lignite)	(2)	(2)
Missouri-Illinois	Illinois	22, 447	22, 447
Missouri-Kansas-Texas [3]	Kansas	322, 191	1, 345, 528
	Missouri	410, 948	
	Oklahoma	506, 011	
	Texas (lignite) [3]	106, 378	
Missouri Pacific	Arkansas	1, 065, 574	11, 280, 465
	Illinois	7, 833, 259	
	Kansas	1, 142, 251	
	Missouri	952, 977	
	Oklahoma	286, 404	
Monessen Southwestern	Pennsylvania	78, 547	78, 547
Monongahela	Pennsylvania	2, 639, 607	14, 274, 765
	West Virginia	11, 635, 158	
Montana, Wyoming & Southern	Montana (bituminous)	597, 933	597, 933
Montour	Pennsylvania	7, 111, 525	7, 111, 525
Nashville, Chattanooga & St. Louis	Alabama	3, 000	1, 108, 112
	Tennessee	1, 105, 112	
New York Central (includes coal shipped over Kanawha and Michigan, Kelley's Creek, Toledo and Ohio Central, and Zanesville and Western)	Ohio	6, 868, 450	13, 747, 274
	Pennsylvania	5, 705, 086	
	West Virginia	1, 173, 738	
Nicholas, Fayette & Greenbrier	do	3, 000, 008	3, 000, 008
Norfolk & Western	Kentucky	6, 099, 312	51, 419, 302
	Virginia	11, 152, 111	
	West Virginia	34, 167, 879	
Northern Pacific	Montana (bituminous)	2, 510, 389	3, 890, 942
	North Dakota (lignite)	629, 181	
	Washington	751, 372	
Oklahoma City-Ada-Atoka	Oklahoma	206, 940	206, 940
Oneida & Western	Tennessee	23, 638	23, 638
Pacific Coast	Washington	109, 900	109, 900
Pennsylvania (includes Pittsburgh, Cincinnati, Chicago and St. Louis)	Illinois	207, 111	58, 522, 406
	Indiana	5, 123, 028	
	Ohio	6, 847, 327	
	Pennsylvania	45, 691, 769	
	West Virginia	653, 171	
Peoria Terminal	Illinois	327, 612	327, 612
Pere Marquette	Michigan	57, 779	57, 779
Pittsburg & Lake Erie	Pennsylvania	3, 329, 205	3, 329, 205
Pittsburg & Shawmut	do	2, 332, 142	2, 332, 142
Pittsburg, Shawmut & Northern	do	480, 852	480, 852
Pittsburgh, Chartiers & Youghiogheny	do	4, 002	4, 002
Pittsburgh, Lisbon & Western	Ohio	49, 832	50, 089
	Pennsylvania	257	
Pittsburgh & West Virginia	Ohio	932, 477	2, 649, 546
	Pennsylvania	1, 314, 345	
	West Virginia	402, 724	
Preston	do	94, 327	94, 327
Rio Grande Southern	Colorado	12, 400	12, 400
Rockdale, Sandow & Southern [3]	Texas	(3)	(3)
St. Louis & O'Fallon	Illinois	376, 627	376, 627
St. Louis-San Francisco	Alabama	2, 426, 688	5, 188, 246
	Arkansas	338, 087	
	Kansas	816, 614	
	Missouri	408, 033	
	Oklahoma	1, 198, 824	
Seaboard Air Lines	Alabama	54, 378	54, 378
Southern	do	3, 908, 956	11, 747, 452
	Illinois	121, 955	
	Indiana	2, 159, 634	
	Kentucky	1, 716, 464	
	Tennessee	2, 641, 662	
	Virginia	1, 198, 781	
Southern Pacific	New Mexico	362, 160	362, 160
Springfield & Southwestern	Illinois	218, 121	218, 121
Springfield Terminal	do	699, 788	699, 788

See footnotes at end of table.

TABLE 22.—*Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, as reported by mine operators, in 1944* [1]—Con.

Route	State	Net tons: By State	Net tons: Total for route
RAILROADS—continued			
Tennessee	Tennessee	1,100,541	1,100,541
Tennessee Central	do	496,795	496,795
Tennessee Coal, Iron & Railroad Co	Alabama	3,113,717	3,113,717
Thomas & Sayreton	do	492,994	492,994
Toledo, Peoria & Western	Illinois	91,116	91,116
Union	Pennsylvania	261,454	261,454
Union Pacific	Colorado	890,788	8,776,640
	Utah	2,550	
	Washington	65,855	
	Wyoming	7,817,447	
Unity	Pennsylvania	1,278,997	1,278,997
Utah	Utah	1,371,964	1,371,964
Virginian	Virginia	173,008	13,347,235
	West Virginia	13,174,227	
Wabash	Illinois	3,122,520	3,779,186
	Iowa	183,989	
	Missouri	472,677	
West Virginia Northern	West Virginia	710,706	710,706
Western Allegheny	Pennsylvania	229,556	229,556
Western Maryland	Maryland	1,045,448	5,508,746
	Pennsylvania	440,477	
	West Virginia	4,022,821	
Wheeling & Lake Erie	Ohio	5,558,189	5,558,189
Winifrede	West Virginia	216,317	216,317
Woodward Iron Co	Alabama	974,494	974,494
Youngstown & Suburban	Ohio	88,409	88,409
Total railroad shipments		527,135,489	527,135,489
WATERWAYS			
Allegheny River	Pennsylvania	1,410,303	1,410,303
Black Warrior River	Alabama	354,240	354,240
Illinois River	Illinois	601,730	601,730
Kanawha River	West Virginia	1,658,711	1,658,711
Monongahela River	Pennsylvania	24,126,803	25,283,205
	West Virginia	1,156,402	
Muskingum River	Ohio	1,073,380	1,073,380
Ohio River	Kentucky	192,081	993,501
	Ohio	30,886	
	West Virginia	770,534	
Tennessee River	Tennessee	143,264	143,264
Total waterway shipments		31,518,334	31,518,334
Total loaded at mines for shipment by railroads and waterways.		558,653,823	558,653,823
Shipped by truck or wagon		40,123,023	40,123,023
Taken by locomotive tenders at tipple		807,679	807,679
Shipped by conveyor or tram to point of consumption.		7,206,392	7,206,392
Coal used by employees		2,545,343	2,545,343
Used at mine for power and heat		2,713,073	2,713,073
Made into beehive coke at mine		7,526,907	7,526,907
Total production		619,576,240	619,576,240

[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding for shipment by rail, and hauled by truck to waterway for shipment by water. In general, figures show quantity of bituminous coal and lignite originated for each railroad and waterway as reported by mine operators. It must be noted that in 1 year operator may report coal loaded on subsidiary railroad and in another year same operator may report coal loaded on parent railroad system.

[2] Tonnage from North Dakota lignite mines shipping on Minneapolis, St. Paul, & Sault Ste. Marie Railway included with that shipped on Great Northern Railway.

[3] Tonnage from Texas lignite mines shipping on Rockdale, Sandow & Southern Railroad included with that shipped on Missouri-Kansas-Texas Railroad.

TABLE 23.—*Bituminous coal and lignite mined by different methods in the United States, by States, in 1944*

State	From underground workings							From strip pits		Grand total production (net tons)
	Mined by hand		Shot from the solid		Cut by machines		Total underground (net tons)	Net tons	Percent of grand total	
	Net tons	Percent of total underground	Net tons	Percent of total underground	Net tons	Percent of total underground				
Alabama	357,163	2.1	3,514,152	20.0	13,682,232	77.9	17,553,547	1,198,618	6.4	18,752,165
Alaska	—	—	347,029	99.6	1,346	.4	348,375	—	—	348,375
Arizona	—	—	6,081	100.0	—	—	6,081	—	—	6,081
Arkansas	—	—	186,447	14.0	1,149,730	86.0	1,336,177	636,264	32.2	1,972,441
Colorado	1,576,526	19.4	214,487	2.6	6,361,020	78.0	8,152,033	15,680	.2	8,167,713
Georgia	—	—	24,285	100.0	—	—	24,285	—	—	24,285
Illinois	122,018	.2	2,880,371	4.9	55,809,188	94.9	58,811,577	17,979,872	23.4	76,791,449
Indiana	74,108	.5	227,359	1.7	13,534,271	97.8	13,835,738	14,126,145	50.5	27,961,883
Iowa	73,093	4.5	580,656	35.6	975,477	59.9	1,629,226	511,710	23.9	2,140,936
Kansas	47,985	16.6	36,746	12.7	204,380	70.7	289,111	3,079,976	91.4	3,369,087
Kentucky	2,077,949	3.2	5,779,773	8.7	58,224,284	88.1	66,082,006	5,273,991	7.4	71,355,997
Maryland	1,078,421	62.0	—	—	659,896	38.0	1,738,317	132,185	7.1	1,870,502
Michigan	—	—	—	—	139,938	100.0	139,938	—	—	139,938
Missouri	45,329	6.2	73,256	10.1	609,833	83.7	728,418	4,050,234	84.8	4,778,652
Montana (bituminous)	8,481	.4	9,069	.4	2,261,405	99.2	2,278,955	2,513,385	52.4	4,792,340
Montana and Texas (lignite)	(1)	—	[1] 55,573	100.0	—	—	55,573	105,668	65.5	161,241
New Mexico	404,937	23.2	197,994	11.4	1,140,743	65.4	1,743,674	—	—	1,743,674
North Dakota (lignite)	(1)	—	[1] 47,783	6.7	661,842	93.3	709,625	1,656,467	70.0	2,366,092
Ohio	62,235	.3	121,479	.5	22,030,202	99.2	22,213,916	11,663,139	34.4	33,877,055
Oklahoma	1,468	.1	143,114	9.2	1,412,369	90.7	1,556,951	1,651,583	51.5	3,208,534
Oregon	—	—	1,453	100.0	—	—	1,453	—	—	1,453
Pennsylvania	13,888,861	11.3	3,845,114	3.1	105,786,386	85.6	123,520,361	22,532,054	15.4	146,052,415
South Dakota (lignite)	(1)	—	[1] 1,405	100.0	—	—	1,405	25,422	94.8	26,827
Tennessee	476,854	6.6	1,243,207	17.4	5,434,915	76.0	7,154,976	111,071	1.5	7,266,047
Utah	11,299	.2	93,000	1.3	7,014,962	98.5	7,119,261	—	—	7,119,261
Virginia	515,029	2.6	1,117,933	5.8	17,718,921	91.6	19,351,883	161,991	.9	19,513,874
Washington	137,121	9.4	625,047	42.7	701,547	47.9	1,463,715	60,426	4.0	1,524,141
West Virginia	4,583,287	3.0	1,955,084	1.3	145,324,799	95.7	151,863,170	12,840,600	7.8	164,703,770
Wyoming	158,604	1.8	190,850	2.1	8,618,663	96.1	8,968,117	571,895	6.0	9,540,012
Total	25,700,768	5.0	23,518,747	4.5	469,458,349	90.5	518,677,864	100,898,376	16.3	619,576,240

[1] Some coal "Mined by hand" included under "Shot from the solid."

TABLE 24.—*Number of coal-cutting machines in bituminous-coal and lignite mines, average output per machine, and percent of total product of underground mines cut by machines in the United States, by States, 1943–44*

State	1943					1944				
	Number of coal-cutting machines in use			Average output per machine (net tons)	Percent of total product of underground mines cut by machines	Number of coal-cutting machines in use			Average output per machine (net tons)	Percent of total product of underground mines cut by machines
	Permissible	Other	Total			Permissible	Other	Total		
Alabama	231	350	581	22,508	78.2	268	326	594	23,034	77.9
Alaska						2		2	673	.4
Arkansas	31	74	105	11,341	84.1	27	61	88	13,065	86.0
Colorado	154	337	491	12,814	75.7	175	321	496	12,825	78.0
Illinois	305	527	832	63,383	94.1	287	541	828	67,402	94.9
Indiana	44	207	251	45,201	96.5	64	185	249	54,355	97.8
Iowa	52	40	92	11,421	49.9	43	43	86	11,343	59.9
Kansas	17	16	33	8,366	68.4	13	13	26	7,861	70.7
Kentucky	[1] 500	[1] 1,062	[1] 1,562	[1] 36,189	92.3	553	1,119	1,672	34,823	88.1
Maryland	15	32	47	16,597	43.1	21	26	47	14,040	38.0
Michigan	7	15	22	7,664	100.0	4	16	20	6,997	100.0
Missouri	27	50	77	9,492	79.0	23	45	68	8,968	83.7
Montana (bituminous)	13	54	67	32,411	99.1	10	54	64	35,334	99.2
New Mexico	44	28	72	15,925	62.0	41	36	77	14,815	65.4
North Dakota (lignite)	17	4	21	29,092	81.4	10	5	15	44,123	93.3
Ohio	265	632	897	25,145	99.1	325	519	844	26,102	99.2
Oklahoma	74	90	164	7,632	90,2	71	75	146	9,674	90.7
Pennsylvania	2,078	1,035	3,113	33,568	84.9	2,356	1,075	3,431	30,833	85.6
Tennessee	51	183	234	23,520	76.7	26	209	235	23,127	76.0
Utah	135	57	192	33,986	97.9	161	55	216	32,477	98.5
Virginia	113	263	376	49,575	91.9	127	234	361	49.083	91.6
Washington	55	2	57	12,533	47.6	62		62	11,315	47.9
West Virginia	[1] 979	[1] 2,352	[1] 3,331	[1] 43,585	95.1	1,104	2,245	3,349	43,393	95.7
Wyoming	36	271	307	26,316	91.4	37	292	329	26,197	96.1
Total	[1] 5,243	[1] 7,681	[1] 12,924	[1] 35,674	90.3	5,810	7,495	13,305	35,284	90.5

[1] Revised figure.

Table 25.—*Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1944* [1]

State and county	Number of strip pits	Number of power shovels: Steam	Electric	All others	Mined by stripping (net tons)	Average number of employees: In strips pits	All others	Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
Alabama:											
Blount and Tuscaloosa	5	4		4	68,429	65	11	76	186	14,127	4.84
Jefferson	7	3		17	256,642	132	45	177	139	24,660	10.41
Marion	1			2	8,913	20	5	25	47	1,175	7.59
St. Clair	1			4	49,442	50	20	70	111	7,750	6.38
Walker	19	7	4	28	771,920	390	115	505	186	93,968	8.21
Winston	3			5	43,272	32	3	35	210	7,364	5.88
Total Alabama	36	14	4	60	1,198,618	689	199	888	168	149,044	8.04
Arkansas:											
Franklin	3	2			27,425	47	9	56	128	7,150	3.84
Johnson	4			7	133,347	66	21	87	130	11,297	11.80
Pope	3			3	59,127	62	16	78	122	9,529	6.20
Sebastian	14			19	416,365	245	70	315	138	43,556	9.56
Total Arkansas	24	2		29	636,264	420	116	536	133	71,532	8.89
Colorado:											
Jackson	1			1	14,508	7	3	10	120	1,200	12.09
Routt	1				1,172	3		3	50	150	7.81
Total Colorado	2			1	15,680	10	3	13	104	1,350	11.61
Illinois:											
Bureau, Grundy, Henry, Jackson, Knox, Saline, and Will	9		26	11	4,251,191	562	495	1,057	291	307,091	13.84
Fulton	10		24	12	7,590,679	390	664	1,054	270	284,548	26.68
La Salle	3		3	1	121,356	26	31	57	174	9,906	12.25
Livingston	1			1	4,332	7		7	189	1,320	3.28
Perry	3		12	3	2,787,083	344	267	611	248	151,372	18.41
Randolph	2		1	1	1,021,708	53	51	104	302	31,408	32.53
St. Clair	3		5	6	1,070,727	97	64	161	295	47,438	22.57
Schuyler	1			2	235,002	27	28	55	305	16,761	14.02
Vermilion	3			5	39,431	21	4	25	111	2,785	14.16
Williamson	3		2	5	858,363	82	67	149	235	34,964	24.55
Total Illinois	38		73	47	17,979,872	1,609	1,671	3,280	271	887,593	20.26

See footnote at end of table.

TABLE 25.—*Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1944*—Con.

State and county	Number of strip pits	Number of power shovels			Mined by stripping (net tons)	Average number of employees			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	All others		In strips pits	All others	Total			
Indiana:											
Clay	15	------	9	28	1,868,299	316	227	543	227	123,304	15.15
Daviess, Dubois, Fountain, and Knox	7	------	2	13	487,686	92	96	188	123	23,130	21.08
Greene	7	4	6	2	1,601,710	331	233	564	181	102,299	15.66
Owen	1	------	2	------	199,130	28	20	48	261	12,512	15.92
Pike	8	1	14	13	4,120,527	441	472	913	248	226,495	18.19
Spencer	3	------	------	6	153,868	45	16	61	224	13,677	11.25
Sullivan	6	1	7	4	988,201	234	162	396	146	57,627	17.15
Vermillion	5	------	2	9	430,137	82	87	169	190	32,147	13.38
Vigo	10	------	2	16	1,042,076	154	83	237	242	57,308	18.18
Warrick	5	------	8	7	3,234,511	284	293	577	304	175,448	18.44
Total Indiana	67	6	52	98	14,126,145	2,007	1,689	3,696	223	823,947	17.14
Iowa:											
Jasper, Keokuk, and Van Buren	4	------	------	2	15,919	14	4	18	226	4,060	3.92
Mahaska	8	------	1	13	176,508	73	39	112	249	27,936	6.32
Marion	8	1	------	16	241,511	65	34	99	225	22,284	10.84
Wapello	3	------	------	9	77,772	30	9	39	242	9,434	8.24
Total Iowa	23	1	1	40	511,710	182	86	268	238	63,714	8.03
Kansas:											
Bourbon	4	1	2	2	213,676	49	23	72	228	16,420	13.01
Cherokee	11	4	7	6	1,381,480	248	151	399	276	110,057	12.55
Crawford	12	9	11	4	1,469,146	349	115	464	242	112,373	13.07
Labette	3	2	------	1	6,979	9	3	12	142	1,704	4.10
Linn and Osage	3	3	------	2	8,695	16	------	16	158	2,532	3.43
Total Kansas	33	19	20	15	3,079,976	671	292	963	252	243,086	12.67
Kentucky:											
Boyd, Elliott, and Knott	3	1	------	2	8,686	9	3	12	136	1,629	5.33
Christian	1	------	------	2	33,238	12	10	22	220	4,840	6.87
Daviess	1	------	------	2	79,000	18	2	20	148	2,960	26.69
Hopkins	20	2	5	35	3,915,662	409	262	671	236	158,178	24.75
Laurel	3	------	------	4	117,104	65	11	76	199	15,123	7.74
Muhlenberg	10	------	------	17	653,437	130	72	202	192	38,790	16.85
Ohio	5	------	------	11	272,741	87	31	118	194	22,894	11.91
Pulaski	1	------	------	2	4,538	11	------	11	105	1,155	3.93

Webster	2			2	86,709	53	21	74	74	5,482	15.82
Whitley	4			5	102,876	43	42	85	181	15,368	6.69
Total Kentucky	50	3	5	82	5,273,991	837	454	1,291	206	266,419	19.80
Maryland:											
Allegany	7			14	94,454	52	7	59	149	8,807	10.72
Garrett	3			3	37,731	52	5	57	71	4,030	9.36
Total Maryland	10			17	132,185	104	12	116	111	12,837	10.30
Missouri:											
Barton	5	2	3	3	273,733	65	22	87	200	17,373	15.76
Bates	4	2	4	2	1,175,077	126	93	219	258	56,442	20.82
Boone	2			3	43,599	17	5	22	226	4,965	8.78
Callaway	4	2		7	197,604	77	24	101	302	30,467	6.49
Dade	2			3	8,686	9		9	300	2,700	3.22
Henry	8	2	3	7	546,921	115	43	158	230	36,360	15.04
Jasper, Johnson, and Randolph	4	1	6	2	773,260	117	51	168	271	45,583	16.96
Lafayette	1				1,587	3		3	280	840	1.89
Macon	1		4	1	614,818	90	79	169	281	47,476	12.95
Moniteau	1				2,080	2		2	298	596	3.49
Monroe	1			1	5,371	9		9	314	2,826	1.90
St. Clair	4	4		1	15,605	27	4	31	93	2,886	5.41
Vernon	11	5	5	3	391,893	111	19	130	236	30,670	12.78
Total Missouri	48	18	25	33	4,050,234	768	340	1,108	252	279,184	14.51
Montana (bituminous): Rosebud	1		7		2,513,385	87	23	110	311	34,188	73.52
Montana and Texas (lignite)	4	2		2	105,668	29	10	39	159	6,220	16.99
North Dakota (lignite)	48	4	12	44	1,656,467	254	203	457	201	91,842	18.04
Ohio:											
Athens, Gallia, Guernsey, Holmes, and Morgan	7			17	285,003	100	41	141	173	24,440	11.66
Belmont	8		1	28	1,053,505	212	71	283	211	59,848	17.60
Carroll	3	2		3	167,913	47	9	56	281	15,716	10.68
Columbiana	18			28	735,091	134	83	217	256	55,499	13.25
Coshocton	2			3	55,716	26	18	44	203	8,932	6.24
Harrison	12		11	29	3,977,230	514	310	824	281	231,480	17.18
Hocking	3			8	130,673	72	41	113	100	11,250	11.62
Jackson	7			6	55,030	27	11	38	219	8,307	6.62
Jefferson	17	8	5	27	2,304,315	368	205	573	232	133,136	17.31
Mahoning	7	3		12	279,916	79	15	94	227	21,305	13.14
Muskingum	3	1		4	473,769	70	24	94	283	26,618	17.80
Noble	3	1		4	170,445	26	9	35	237	8,308	20.52
Perry	15		1	31	665,741	189	78	267	154	40,985	16.24
Portage	1			2	94,013	17	5	22	309	6,807	13.81
Stark	8	1		19	286,828	117	38	155	181	28,018	10.24
Tuscarawas	18	3	3	24	823,022	192	52	244	274	66,887	12.30

See footnote at end of table.

TABLE 25.—*Stripping operations of all types in the bituminous-coal and lignite fields of the United States, by States and counties, in 1944*—Con

State and county	Number of strip pits	Number of power shovels			Mined by stripping (net tons)	Average number of employees			Average number of days mines were active	Number of man-days worked	Average tons per man per day
		Steam	Electric	All others		In strips pits	All others	Total			
Ohio—Continued											
Vinton	4			4	90, 586	39	6	45	252	11, 318	8. 00
Wayne	1			2	14, 343	8		8	117	936	15. 32
Total Ohio	137	19	21	251	11, 663, 139	2, 237	1, 016	3, 253	234	759, 790	15. 35
Oklahoma:											
Coal	4		2	9	226, 167	82	39	121	179	21, 700	10. 42
Craig, Haskell, Muskogee, Pittsburg, Tulsa, and Wagoner	11	5	3	11	933, 377	222	93	315	223	70, 101	13. 31
Rogers	3	5	3		492, 039	100	59	159	266	42, 329	11. 62
Total Oklahoma	18	10	8	20	1, 651, 583	404	191	595	225	134, 130	12. 31
Pennsylvania:											
Allegheny	58	6		98	3, 021, 118	685	183	868	197	170, 649	17. 70
Armstrong	19			28	748, 194	220	107	327	171	55, 957	13. 37
Beaver	5			13	218, 774	65	19	84	273	22, 922	9. 54
Bedford	3			7	135, 350	57	17	74	186	13, 799	9. 81
Bradford	1			1	2, 368	6		6	71	426	5. 56
Butler	18	2		34	526, 625	179	61	240	173	41, 542	12. 68
Cambria	31			37	865, 384	408	111	519	162	84, 179	10. 28
Cameron	1			1	3, 236	5		5	280	1, 400	2. 31
Centre	10	2		18	374, 922	139	35	174	198	34, 442	10. 89
Clarion	28			68	2, 045, 523	591	218	809	217	175, 497	11. 66
Clearfield	75	12		118	2, 590, 883	1, 126	352	1, 478	184	271, 617	9. 54
Clinton	4	4		6	182, 048	105	27	132	206	27, 152	6. 70
Fayette	47	7		54	1, 278, 681	409	112	521	141	73, 364	17. 43
Greene	8			13	285, 769	123	26	149	149	22, 163	12. 89
Huntingdon and Lycoming	4			12	127, 505	80	29	109	113	12, 267	10. 39
Indiana	28	2	2	53	1, 570, 518	463	129	592	194	114, 601	13. 70
Jefferson	27	1		42	616, 124	299	84	383	144	55, 204	11. 16
Lawrence	6			8	56, 258	32	19	51	113	5, 776	9. 74
Mercer	5			10	442, 574	65	11	76	242	18, 390	24. 07
Somerset	29			43	1, 048, 283	410	159	569	135	76, 923	13, 63
Tioga	3	2		3	59, 212	31	10	41	156	6, 385	9. 27
Venango	4			5	111, 897	36	16	52	155	8, 084	13. 84
Washington	30	6	3	65	4, 243, 704	681	296	977	245	239, 598	17. 71
Westmoreland	52	8		65	1, 977, 104	522	108	630	173	109, 045	18. 13
Total Pennsylvania	496	52	5	802	22, 532, 054	6, 737	2, 129	8, 866	185	1, 641, 382	13. 73
South Dakota (lignite)	3			5	25, 422	20	2	22	199	4, 372	5. 81

Tennessee:											
Anderson, Marion, and Morgan	3			4	35,862	30	7	37	93	3,430	10.46
Campbell	1			2	7,831	16	16	32	82	2,616	2.99
Fentress	1			1	41,189	14	4	18	211	3,798	10.84
Hamilton	1			2	21,586	10	5	15	109	1,635	13.20
Scott	1			1	4,603	14	4	18	39	702	6.56
Total Tennessee	7			10	111,071	84	36	120	102	12,181	9.12
Virginia:											
Buchanan	1			2	128,730	30	10	40	172	6,866	18.75
Wise	4			4	33,261	32	2	34	95	3,246	10.25
Total Virginia	5			6	161,991	62	12	74	137	10,112	16.02
Washington:											
King	2			3	7,195	9		9	152	1,369	5.26
Kittitas	2		2	1	49,878	16	5	21	183	3,846	12.97
Lewis	1			1	3,353	8	3	11	38	418	8.02
Total Washington	5		2	5	60,426	33	8	41	137	5,633	10.73
West Virginia:											
Barbour	16			27	876,712	310	86	396	174	68,934	12.72
Boone, Clay, Gilmer, Hancock, Marshall, Ohio, and Upshur	8	3		11	333,195	88	25	113	165	18,695	17.82
Brooke	11		2	18	953,531	205	46	251	192	48,148	19.80
Fayette	19	2		30	872,371	368	71	439	148	65,189	13.38
Greenbrier	9	2		23	534,932	222	37	259	187	48,392	11.05
Harrison	71	3	5	137	6,895,044	1,624	494	2,118	185	392,509	17.57
Marion	6			8	302,596	86	39	125	145	18,100	16.72
McDowell	1			1	15,849	22	8	30	77	2,310	6.86
Mingo	1			3	164,410	27	12	39	305	11,895	13.82
Monongalia	7			17	587,976	119	48	167	181	30,211	19.46
Nicholas	3	1		5	140,163	61	23	84	132	11,088	12.64
Preston	7	3		8	295,447	159	84	243	155	37,627	7.85
Raleigh	7			9	193,632	81	31	112	137	15,339	12.62
Randolph	6	1		18	420,743	185	79	264	131	34,466	12.21
Taylor	5			8	253,999	109	21	130	107	13,912	18.26
Total West Virginia	177	15	7	323	12,840,600	3,666	1,104	4,770	171	816,815	15.72
Wyoming:											
Campbell and Sheridan	3		2	3	328,459	53	43	96	165	15,835	20.74
Carbon	3	1		8	231,594	65	26	91	208	18,908	12.25
Converse	2			1	11,842	7		7	208	1,454	8.14
Total Wyoming	8	1	2	12	571,895	125	69	194	187	36,197	15.80
Total United States	1,240	166	244	1,902	100,898,376	21,035	9,665	30,700	207	6,351,568	15.89

[1] On returns from mines combining stripping and underground methods in same operation, tonnage has been separated and figures on employment prorated so that this table includes only data pertaining to strip mining

TABLE 26.—*Summary of operations of power strip pits proper in the bituminous-coal and lignite fields of the United States, by States, in 1944*

State	Number of strip pits	Number of power shovels			Mined by stripping (net tons)	Number of men employed	Average number of days mines were active	Average tons per man per day
		Steam	Electric	All others				
Power strip pits proper:								
Alabama	33	14	4	60	1, 192, 761	876	169	8. 06
Arkansas	19	2		29	621, 204	492	138	9. 18
Colorado	1			1	14, 508	10	120	12. 09
Illinois	38		73	47	17, 979, 872	3, 280	271	20. 26
Indiana	58	6	52	98	14, 109, 230	3, 669	224	17. 20
Iowa	22	1	1	40	510, 679	265	240	8. 04
Kansas	27	19	20	15	3, 061, 251	934	255	12. 84
Kentucky	50	3	5	82	5, 273, 991	1, 291	206	19. 80
Maryland	10			17	132, 185	116	111	10. 30
Missouri	44	18	25	33	4, 043, 186	1, 096	252	14. 62
Montana (bituminous)	1		7		2, 513, 385	110	311	73. 52
Montana and Texas (lignite)	3	2		2	105, 486	37	168	17. 01
North Dakota (lignite)	35	4	12	44	1, 648, 486	433	209	18. 23
Ohio	135	19	21	251	11, 654, 701	3, 248	234	15. 36
Oklahoma	17	10	8	20	1, 650, 161	591	226	12. 33
Pennsylvania	480	52	5	802	22, 468, 666	8, 764	186	13. 78
South Dakota (lignite)	3			5	25, 422	22	199	5. 81
Tennessee	7			10	111, 071	120	102	9. 12
Virginia	5			6	161, 991	74	137	16. 02
Washington	5		2	5	60, 426	41	137	10. 73
West Virginia	175	15	7	323	12, 836, 211	4, 762	171	15. 73
Wyoming	7	1	2	12	570, 404	192	187	15. 87
Total from power strip pits proper	1, 175	166	244	1, 902	100, 745, 277	30, 423	208	15. 94
Horse stripping operations	65				153, 099	277	109	5. 08
Grand total	1, 240	166	244	1, 902	100, 898, 376	30, 700	207	15. 89

TABLE 27.—*Summary of operations of underground bituminous-coal and lignite mines where shot holes were power-drilled in the United States, by States, in 1944*

State	Number of mines using power drills		Number of power drills								Net tons produced in working places where shot holes were power-drilled			Total production from mines using power drills (net tons)		
			Electric				Compressed air									
	In coal and coal and rock	In rock only	In coal only	In coal and rock	In rock only	Total	In coal only	In coal and rock	In rock only	Total	Electric drills	Compressed-air drills	Total	In coal and coal and rock	In rock only	Total
Alabama	57	5	704	150	14	868	------	2	137	139	12,125,893	2,842	12,128,735	14,064,499	308,424	14,372,923
Alaska	2	------	12	------	3	15	12	------	------	12	68,407	120.551	188,958	188,958	------	188,958
Arkansas	5	22	14	5	6	25	------	------	48	48	306,354	------	306.354	306,354	807,635	1,113,989
Colorado	60	5	265	61	7	333	2	4	47	53	4,738,691	13,955	4,752,646	6,232,149	693,717	6,925,866
Illinois	139	2	1,010	107	11	1,128	11	------	33	44	53,733,501	382,570	54,116,071	55,015,497	283,081	55,298,578
Indiana	32	1	193	68	9	270	------	2	2	4	12,799,961	48,916	12,848,877	12,960,975	78,738	13,039,713
Iowa	10	------	29	6	------	35	------	------	------	------	462,740	------	462,740	462,740	------	462,740
Kentucky	230	22	1,067	154	47	1,268	30	------	171	201	42,117,482	890,583	43,008,065	49,168,351	4,030,045	53,198,396
Maryland	5	1	24	3	6	33	------	------	1	1	315,721	------	315,721	678,585	160,967	839,552
Michigan	3	------	7	1	------	8	------	------	1	1	96,860	------	96,860	134,113	------	134,113
Missouri	4	2	6	------	------	6	------	------	2	2	130,036	------	130,036	130,036	149,283	279,319
Montana (bituminous and lignite)	11	------	50	2	1	53	2	------	3	5	2,215,733	15,823	2,231,556	2,231,556	------	2,231,556
New Mexico	4	------	26	------	------	26	------	------	7	7	862,732	------	862,732	862,732	------	862,732
North-South Dakota (lignite)	17	1	24	------	1	25	------	------	------	------	582,446	------	582,446	586,602	10,001	596,603
Ohio	49	6	337	60	32	429	------	------	6	6	15,758,496	------	15,758,496	16,774,695	772,292	17,546,987
Oklahoma	10	4	47	21	12	80	------	1	6	7	769,809	6,100	775,909	782,021	241,281	1,023,302
Pennsylvania	184	63	1,281	353	110	1,744	76	5	544	625	59,494,865	2,600,140	62,095,005	80,489,144	15,055,033	95,544.177
Tennessee	30	6	139	3	6	148	21	1	38	60	2,791,416	324,480	3,115,896	4,304,989	878,602	5,183,591
Utah	30	------	244	7	3	254	------	------	31	31	6,978,147	------	6,978,147	7,043,972	------	7,043,972
Virginia	45	6	212	------	3	215	------	------	69	69	8,381,476	------	8,381,476	12,904,923	1,395,973	14,300,896
Washington	19	------	75	6	1	82	93	48	35	176	336,950	898,766	1,235,716	1,235,716	------	1,235,716
West Virginia	328	55	1,954	233	84	2,271	44	6	352	402	83,128,000	1,713,588	84,841,588	110,394,585	15,151,814	125,546,399
Wyoming	26	------	432	5	2	439	4	------	6	10	8,853,614	47,881	8,901,495	8,901,495	------	8,901,495
Total	1,300	201	8,152	1,245	358	9,755	295	69	1,539	1,903	317,049,330	7,066,195	324,115,525	385,854,687	40,016,886	425,871,573

MECHANICAL LOADING

Mechanical loading of coal in underground bituminous coal and lignite mines continued to advance during 1944, with a total of 274,189,132 tons loaded, as compared with 249,805,214 tons in 1943. During 1928, the first year complete data on mechanical loading were available, less than 5 percent of the underground production was mechanically loaded; this percentage has increased rapidly and 1944 marks the first year that more than one-half of the underground output was loaded mechanically.

Mechanical loading equipment used in underground coal mines is divided into two types: devices that practically eliminate hand shoveling and those that greatly reduce the labor involved in hand shoveling. Devices in the first category include mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads and are designated as "machines." Those in the second category include all types of hand loaded face conveyors and pit-car loaders and are designated as "conveyors."

Sales of mechanical loading equipment in 1945.—The estimated capacity of mechanical loading equipment sold for underground use in all coal mines was 25 percent more in 1945 than in 1944. Table 28 shows the sales reported, by type of equipment, and the number of manufacturers reporting for 1938–45.

Sales of conveyors to bituminous coal and lignite mines in 1945 totaled 738 units. The figures for 1942–45 exclude duckbills, which were included in all previous years. Therefore, these sales are not comparable with those for 1941 or earlier years. By excluding sales of duckbills, some of the overlapping sales of conveyors were eliminated. However, it appears that a certain amount of overlapping remains; for instance, in 1943 there were 4,417 conveyors (hand-loaded and those equipped with duckbills) in active use in bituminous-coal and lignite mines, as reported by mine operators. By adding 1943 conveyor sales of 798 units, 5,215 units appeared available for use in 1944, whereas the actual number reported in use by mine operators was 4,567, or 648 less. This difference represents idle or worn-out and obsolete equipment, duplications in reporting sales, and a small number of conveyors used in conjunction with mobile loaders.

The number of mobile loaders, scrapers, and conveyors shipped into the various States and groups of States in 1945 and the number of units in actual use in 1944 are shown in table 30.

Statistics on mechanical loading in bituminous-coal and lignite mines in 1944.—During 1944 the approximate percentage of the tonnage loaded by each type of equipment was as follows: Mobile loaders, 74; hand-loaded conveyors, 16; duckbills, 8; pit-car loaders, 1; and scrapers, 1.

Mobile loaders handle more coal than all the other types of mechanical loading devices combined. Where coal is loaded by mobile loaders it is most commonly loaded directly into mine cars, but some tonnage is loaded into shuttle cars or onto conveyors. During 1944, 77 percent of the bituminous coal and lignite handled by mobile loaders was loaded directly into mine cars, 19 percent into shuttle cars, and 4 percent onto conveyors.

During 1944 in underground bituminous coal and lignite mines 2,737 mobile loaders handled 202,875,221 net tons, an average of 74,123 tons per mobile loader per year; scrapers averaged 15,419; pit-car loaders, 7,615; duckbills, 17,403; and hand-loaded face conveyors, 13,898, per year per unit for the same period (see tables 29 and 31).

Mechanical loading by States.—West Virginia has been the leading producer of mechanically loaded coal since 1939. During 1944 West Virginia produced 79,972,476 tons of mechanically loaded coal, followed by Illinois with 50,865,235, Pennsylvania with 48,535,374, Kentucky with 23,428,629, and Ohio with 15,124,377 tons. These five States produced 80 percent of the total output of underground mechanically loaded bituminous coal in the United States in 1944.

Detailed data by States on number of mines and machines and 1944 production of mechanically loaded coal compared with total production at mines using mechanical loading devices are given in table 32. Comparative changes in underground mechanical loading in 1943–44, by States, are shown in table 33.

Table 34 shows bituminous coal and lignite mined by stripping compared with underground hand-loaded and machine-loaded tonnage, by States, for 1944.

TABLE 28.—*Units of mechanical loading equipment sold to bituminous-coal and lignite mines for underground use in the United States, as reported by manufacturers, 1938–45.*

	1938	1939	1940	1941	1942	1943	1944	1945	Change, 1945 from 1944 (percent)
Type of equipment:									
Mobile loaders	241	292	233	367	352	234	282	349	+23.8
Scrapers [1]	6	18	36	8	15	13	20	6	−70.0
Conveyors [2]	749	1,095	1,573	1,800	1,167	798	580	738	+27.2
Pit-car loaders	139	2	3	10	2	1		(3)	
Total, all types	1,135	1,407	1,845	2,185	1,536	1,046	882	1,093	+23.9
Number of manufacturers reporting	29	31	32	32	28	24	22	25	

[1] Reported as scrapers or scraper haulers and hoists.
[2] Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads. Sales of both loading heads and shaker conveyors were counted for the years 1938–41, inclusive, but the figures for 1942–45, inclusive, do not include loading heads separately.
[3] Discontinued canvass of sales of pit-car loaders in 1945.

TABLE 29.—*Units of mechanical loading equipment in use in underground bituminous-coal and lignite mines in the United States, 1939–44*

	1939	1940	1941	1942	1943	1944	Change, 1944 from 1943 (percent)
Type of equipment:							
Mobile loaders	1,573	1,720	1,985	2,301	2,525	2,737	+8.4
Scrapers	131	116	109	93	83	87	+4.8
Pit-car loaders	873	697	607	481	321	241	−24.9
Conveyors equipped with duckbills or other self-loading heads	559	656	788	1,062	1,226	1,331	+8.6
Hand-loaded conveyors	1,834	2,263	2,807	3,041	3,191	3,236	+1.4
Total, all types	4,970	5,452	6,296	6,978	7,346	7,632	+3.9

TABLE 30.—*Comparison of mechanical loading equipment and "mother" conveyors in actual use in bituminous-coal and lignite mines in the United States in 1944 with sales reported in 1945, by States and regions*

State and region	Mechanical loading equipment						"Mother" conveyors [2]	
	Mobile loaders		Scrapers		Conveyors [1]			
	In use in 1944	Sales in 1945	In use in 1944	Sales in 1945	In use in 1944	Sales in 1945	In use in 1944	Sales in 1945
Northern Appalachian States:								
Maryland					32			2
Michigan					5	2		2
Ohio	161	18			203	20	27	4
Pennsylvania	583	80	12		833	97	84	15
Southern Appalachian States:								
Alabama	91	14	47	2	394	37	70	3
Kentucky	212	54			504	126	76	21
Tennessee	13	1			133	40	21	8
Virginia	61	12			111	52	11	5
West Virginia	674	130	4		1, 308	265	243	56
Middle Western States:								
Illinois	587	23			25	18	25	17
Indiana	164	7				6	1	1
Trans-Mississippi States [3]	191	10	24	4	1, 019	75	86	3
Total	2, 737	349	87	6	4, 567	738	644	137

[1] Includes hand-loaded conveyors and conveyors equipped with duckbills or other self-loading heads.
[2] Includes all haulage conveyors with capacities over 500 feet except main slope conveyors.
[3] Includes Arkansas, Colorado, Iowa, Montana, New Mexico, North Dakota, Oklahoma, Utah, Washington, and Wyoming.

TABLE 31.—*Bituminous coal and lignite mechanically loaded underground in the United States, by types of machines, 1943–44*

Type of equipment	1943		1944	
	Net tons	Percent of total	Net tons	Percent of total
Mobile loaders	179, 008, 477	71. 7	202, 875, 221	74. 0
Scrapers	1, 349, 435	. 5	1, 341, 450	. 5
Pit-car loaders	2, 668, 674	1. 1	1, 835, 178	. 7
Conveyors equipped with duckbills or other self-loading heads	22, 916, 590	9. 2	23, 163, 541	8. 4
Hand-loaded conveyors	43, 862, 038	17. 5	44, 973, 742	16. 4
Grand total loaded mechanically	249, 805, 214	100. 0	274, 189, 132	100. 0

TABLE 32.—*Mechanical loading underground in bituminous-coal and lignite mines in the United States, by States, in 1944*

State	Number of mines				Number of machines					Production mechanically loaded (net tons)			Total underground production at mines using mechanical loading devices (net tons)			
	Using loading machines only [1]	Using conveyors only [2]	Using both loading machines and conveyors	Total	Mobile loading machines	Scrapers	Conveyors equipped with duckbills or other self-loading heads	Pit-car loaders	Hand-loaded conveyors [3]	Loaded by machines [1]	Handled by conveyors [2]	Total	Mines using loading machines only [1]	Mines using conveyors only [2]	Mines using both loading machines and conveyors	Total
Alabama	17	25	12	54	91	47	19	6	375	5,013,477	4,991,218	10,004,695	5,042,614	4,266,175	4,737,341	14,046,130
Arkansas	------	21	------	21	------	------	------	------	59	------	898,388	898,388	------	929,524	------	929,524
Colorado	35	21	4	60	29	2	178	------	86	3,363,697	747,482	4,111,179	4,739,621	1,003,075	455,417	6,198,113
Illinois	69	3	6	78	587	------	24	88	1	50,116,239	748,996	50,865,235	47,321,878	403,574	4,536,071	52,261,523
Indiana	20	2	2	24	164	------	------	23	------	12,349,719	151,604	12,501,323	11,772,176	171,702	669,543	12,613,421
Iowa	2	1	------	3	2	------	14	------	4	[4] 274,593	(4)	274,593	284,621	85,065	------	369,686
Kentucky	73	36	18	127	212	------	195	19	309	19,759,017	3,669,612	23,428,629	20,878,492	4,627,861	10,569,209	36,075,562
Maryland	------	3	1	4	------	------	3	------	29	(5)	[5] 269,008	269,008	------	171,291	202,135	373,426
Michigan	------	1	------	1	------	------	------	------	5	------	61,922	61,922	------	99,155	------	99,155
Montana (bituminous and lignite)	8	1	1	10	50	------	7	6	2	2,147,114	30,000	2,177,114	2,020,043	46,230	150,694	2,216,967
New Mexico	3	------	1	4	11	12	------	------	1	778,795	3,867	782,662	756,170	------	374,630	1,130,800
North Dakota (lignite)	3	------	------	3	7	------	------	------	------	561,763	------	561,763	695,972	------	------	695,972
Ohio	28	3	4	35	161	------	167	------	36	14,493,503	630,874	15,124,377	14,921,797	149,437	1,305,794	16,377,028
Oklahoma	1	9	1	11	4	------	2	------	125	101,747	853,215	954,962	1,747	809,072	151,246	962,065
Pennsylvania	87	55	36	178	583	12	91	56	742	38,553,892	9,981,482	48,535,374	52,478,920	11,548,190	13,428,541	77,455,651
Tennessee	6	15	7	28	13	------	17	------	116	651,107	1,845,951	2,497,058	682,270	2,562,119	947,253	4.191,642
Utah	13	5	3	21	58	------	85	------	27	6,178,827	265,732	6,444,559	5,841,743	215,264	695,215	6,752,222
Virginia	17	8	7	32	61	------	16	------	95	3,726,643	1,351,810	5,078,453	7,032,222	1,209,950	1,315,360	9,557,532
Washington	5	8	1	14	2	1	11	------	89	134,926	699,349	834,275	240,118	720,107	39,744	999,969
West Virginia	136	109	80	325	674	4	240	38	1,068	61,007,359	18,965,117	79,972,476	65,028,125	21,847,592	26,882,416	113,758,133
Wyoming	15	6	3	24	28	9	262	5	67	8,167,794	643,293	8,811,087	7,680,658	339,202	811,576	8,831,436
Total: 1944	538	332	187	1,057	2,737	87	1,331	241	3,236	227,380,212	46,808,920	274,189,132	247,419,187	51,204,585	67,272,185	365,895,957
1943	490	338	160	988	2,525	83	1,226	321	3,191	203,274,502	46,530,712	249,805,214	225,162,653	56,610,756	65,019,544	346,792,953
Percent change, 1944 from 1943	+9.8	−1.8	+16.9	+7.0	+8.4	+4.8	+8.6	−24.9	+1.4	+11.9	+0.6	+9.8	+9.9	−9.6	+3.5	+5.5

[1] Includes mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads. Some mines in this class also use conveyors or shuttle cars in conjunction with mobile loaders to perform initial phase of transportation.
[2] Includes hand-loaded conveyors and pit-car loaders.
[3] Number of units.
[4] In Iowa "Loaded by machines" includes small amount "Handled by conveyors."
[5] In Maryland "Handled by conveyors" includes small amount "Loaded by machines."

TABLE 33.—*Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of machines in the United States, by States, 1943–44*

State	Net tons						Handled by each class (percent)				Underground output mechanically loaded (percent)	
	1943			1944			1943		1944			
	Loaded by machines [1]	Handled by conveyors [2]	Total	Loaded by machines [1]	Handled by conveyors [2]	Total	Loaded by machines [1]	Handled by conveyors [2]	Loaded by machines [1]	Handled by conveyors [2]	1943	1944
Alabama	4,050,427	4,278,028	8,328,455	5,013,477	4,991,218	10,004,695	48.6	51.4	50.1	49.9	49.8	57.0
Arkansas		995,929	995,929		898,388	898,388		100.0		100.0	70.4	67.2
Colorado	3,305,913	628,039	3,933,952	3,363,697	747,482	4,111,179	84.0	16.0	81.8	18.2	47.3	50.4
Illinois	46,456,742	964,002	47,420,744	50,116,239	748,996	50,865,235	98.0	2.0	98.5	1.5	84.7	86.5
Indiana	10,211,566	181,864	10,393,430	12,349,719	151,604	12,501,323	98.3	1.7	98.8	1.2	88.4	90.4
Iowa	218,358	62,898	281,256	[3] 274,593	([3])	274,593	77.6	22.4	[3] 100.0	([3])	13.4	16.9
Kentucky	16,921,659	2,661,762	19,583,421	19,759,017	3,669,612	23,428,629	86.4	13.6	84.3	15.7	32.0	35.5
Maryland	([4])	[4] 278,030	278,030	([4])	[4] 269,008	269,008	([4])	[4] 100.0	([4])	[4] 100.0	15.4	15.5
Michigan		74,486	74,486		61,922	61,922		100.0		100.0	44.2	44.2
Montana (bituminous and lignite)	2,008,846	10,000	2,018,846	2,147,114	30,000	2,177,114	99.5	.5	98.6	1.4	91.4	93.3
New Mexico	764,620		764,620	778,795	3,867	782,662	100.0		99.5	.5	41.3	44.9
North Dakota (lignite)	387,802		387,802	561,763		561,763	100.0		100.0		51.7	79.2
Ohio	14,442,391	878,417	15,320,808	14,493,503	630,874	15,124,377	94.3	5.7	95.8	4.2	67.3	68.1
Oklahoma	4,000	754,194	758,194	101,747	853,215	954,962	0.5	99.5	10.7	89.3	54.6	61.3
Pennsylvania	31,743,501	10,909,519	42,653,020	38,553,892	9,981,482	48,535,374	74.4	25.6	79.4	20.6	34.7	39.3
Tennessee	471,673	1,495,495	1,967,168	651,107	1,845,951	2,497,058	24.0	76.0	26.1	73.9	27.4	34.9
Utah	5,682,437	278,114	5,960,551	6,178,827	265,732	6,444,559	95.3	4.7	95.9	4.1	89.4	90.5
Virginia	2,805,949	1,897,175	4,703,124	3,726,643	1,351,810	5,078,453	59.7	40.3	73.4	26.6	23.2	26.2
Washington	158,290	692,429	850,719	134,926	699,349	834,275	18.6	81.4	16.2	83.8	56.7	57.0
West Virginia	55,648,810	18,869,043	74,517,853	61,007,359	18,965,117	79,972,476	74.7	25.3	76.3	23.7	48.8	52.7
Wyoming	7,991,518	621,288	8,612,806	8,167,794	643,293	8,811,087	92.8	7.2	92.7	7.3	97.5	98.2
Total	203,274,502	46,530,712	249,805,214	227,380,212	46,808,920	274,189,132	81.4	18.6	82.9	17.1	48.9	52.9

[1] Includes mobile loaders, scrapers, and conveyors equipped with duckbills or other self-loading heads.
[2] Includes hand-loaded conveyors and pit-car loaders.
[3] In Iowa "Loaded by machines" includes small amount "Handled by conveyors."
[4] In Maryland "Handled by conveyors" includes small amount "Loaded by machines."

TABLE 34.—*Bituminous coal and lignite in the United States mined underground and from strip pits and method of loading underground, in net tons, by States, in 1944*

State	Mined by stripping	Mined underground			Grand total production
		Hand-loaded	Machine-loaded	Total	
Alabama	1,198,618	7,548,852	10,004,695	17,553,547	18,752,165
Alaska		348,375		348,375	348,375
Arizona		6,081		6,081	6,081
Arkansas	636,264	437,789	898,388	1,336,177	1,972,441
Colorado	15,680	4,040,854	4,111,179	8,152,033	8,167,713
Georgia		24,285		24,285	24,285
Illinois	17,979,872	7,946,342	50,865,235	58,811,577	76,791,449
Indiana	14,126,145	1,334,415	12,501,323	13,835,738	27,961,883
Iowa	511,710	1,354,633	274,593	1,629,226	2,140,936
Kansas	3,079,976	289,111		289,111	3,369,087
Kentucky	5,273,991	42,653,377	23,428,629	66,082,006	71,355,997
Maryland	132,185	1,469,309	269,008	1,738,317	1,870,502
Michigan		78,016	61,922	139,938	139,938
Missouri	4,050,234	728,418		728,418	4,778,652
Montana (bituminous)	2,513,385	112,448	2,166,507	2,278,955	4,792,340
Montana and Texas (lignite)	105,668	44,966	10,607	55,573	161,241
New Mexico		961,012	782,662	1,743,674	1,743,674
North Dakota (lignite)	1,656,467	147,862	561,763	709,625	2,366,092
Ohio	11,663,139	7,089,539	15,124,377	22,213,916	33,877,055
Oklahoma	1,651,583	601,989	954,962	1,556,951	3,208,534
Oregon		1,453		1,453	1,453
Pennsylvania	22,532,054	74,984,987	48,535,374	123,520,361	146,052,415
South Dakota (lignite)	25,422	1,405		1,405	26,827
Tennessee	111,071	4,657,918	2,497,058	7,154,976	7,266,047
Utah		674,702	6,444,559	7,119,261	7,119,261
Virginia	161,991	14,273,430	5,078,453	19,351,883	19,513,874
Washington	60,426	629,440	834,275	1,463,715	1,524,141
West Virginia	12,840,600	71,890,694	79,972,476	151,863,170	164,703,770
Wyoming	571,895	157,030	8,811,087	8,968,117	9,540,012
Total	100,898,376	244,488,732	274,189,132	518,677,864	619,576,240

MECHANICAL CLEANING

In 1927, the first year complete data were collected on mechanical cleaning of bituminous coal, there were 24,041,463, and 3,650,584 net tons cleaned by wet and pneumatic methods, respectively, a total of 27,692,047 net tons of clean coal or 5 percent of the total production. This percentage has increased each year and in 1944 it amounted to more than 25 percent or 158,727,129 net tons of clean coal.

Tables 35, 36, 39, and 40 include mechanical cleaning data on all coal mined in the United States except Pennsylvania anthracite. Tables 37 and 38 are upon the same basis but do not include consumer-operated plants. There are no mechanical cleaning plants at lignite mines.

Consumer-operated plants include plants owned by steel companies which receive coal from various mines (but usually from affiliated companies), clean it, and then consume it directly at the plant.

In the following tables coal cleaned at consumer-operated plants was tabulated in State or district where the plant was located. All coal cleaned at plants other than consumer-operated plants was included in State or district from which the coal was mined.

Table 35 compares bituminous coal cleaned in 1941–44, inclusive, by method of cleaning. Wet methods increased and pneumatic methods decreased in 1944 from 1943.

Mechanical cleaning by types of equipment.—The tonnage of bituminous coal cleaned by wet-washing methods reached 138,662,689 net tons in 1944—an increase of 11.5 percent over 1943. The quantity cleaned by pneumatic methods was 20,064,440 net tons—a decrease of 5.4 percent.

Table 36 compares the number of cleaning plants and the net tons of cleaned coal, by types of equipment, for 1943 and 1944. During 1944, 410 wet-washing and 82 pneumatic cleaning plants were in operation. Fifty-three tipples used both wet and dry methods at the same plants; deducting these duplications gives a net total of 439 plants that cleaned coal in 1944 compared with 432 in 1943.

Wet methods of cleaning coal include piston- or common-type jigs, Baum-type jigs, concentrating tables, launders and upward-current classifiers, and any combinations of these four methods. Baum-type jigs cleaned approximately 41 percent of the total coal cleaned by wet methods during 1944.

Pnuematic methods of coal cleaning include air tables, air flow, air sand, and any combinations of these three methods. During 1944, air tables cleaned 59 percent of the coal cleaned by pneumatic methods.

Mines served by cleaning plants, exclusive of those that ship to washeries operated by steel companies, produced a total of 232,935,780 tons, or 37.6 percent, of the total bituminous output in 1944. In this same group of mines, 148,454,987 tons were mechanically cleaned; therefore, 63.7 percent of the coal produced at mines with cleaning plants in 1944 was cleaned at the mine. The rest of the output (36.3 percent) presumably represents the larger sizes commonly picked by hand.

Table 37 shows total production of coal at mines with cleaning plants by methods of preparation in 1943 and 1944.

Coal cleaning by States.—The following States led in volume of coal mechanically cleaned in the United States in 1944: Pennsylvania, 23.5 percent of total; West Virginia, 20.8; Illinois, 20.8; Alabama, 9.1; and Indiana, 7.4 percent. These five States accounted for 81.6 percent of the total mechanically cleaned coal in 1944. Table 39 shows the number of plants in operation, tons of clean coal, and percentage of State output mechanically cleaned in 1943 and 1944.

Relation between raw coal, clean coal, and refuse.—For every 100 tons of raw coal cleaned during 1944 at the mines, 86.8 tons of clean merchantable coal, on an average, were obtained, and 13.2 tons of refuse were discarded. Table 40 shows total production of mines with cleaning plants and results of cleaning operations, by States.

Methods of mining at mines served by cleaning plants.—Mechanical loading, both in underground mines and strip pits, appears to be closely related to mechanical cleaning. Table 38 shows the mining methods at mines having cleaning plants. Production of coal from strip mines in 1944 was 100,898,376 tons (see table 34), of which 32,444,227 tons (32.2 percent) came from strip mines having mechanical cleaning tipples. Underground coal loaded mechanically in 1944 totaled 274,189,132 tons, of which 137,926,900 tons (50.3 percent) passed through tipples equipped with mechanical-cleaning devices. Hand-loaded underground coal production in 1944 totaled 244,488,732 tons, of which 25.6 percent passed through tipples equipped with cleaning plants.

TABLE 35.—*Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, in net tons of clean coal, 1941–44*

Method of cleaning	1941	1942	1943	1944	Change 1944 from 1943 (percent)
By wet methods:					
At mines	91, 126, 091	111, 210, 109	114, 407, 591	128, 390, 547	+12. 2
At consumer-operated cleaning plants	9, 251, 543	10, 789, 749	9, 967, 184	10, 272, 142	+3. 1
Total wet methods	100, 377, 634	121, 999, 858	124, 374, 775	138, 662, 689	+11. 5
By pneumatic methods	17, 161, 888	20, 187, 488	21, 201, 074	20, 064, 440	−5. 4
Grand total	117, 539, 522	142, 187, 346	145, 575, 849	158, 727, 129	+9. 0

TABLE 36.—*Bituminous coal cleaned in the United States, by types of equipment in actual operation, 1943–44*

Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania included]

Type of equipment	Plants in operation		Net tons of clean coal		Cleaned by each type (percent of total)	
	1943	1944	1943	1944	1943	1944
Wet methods:						
Jigs	214	216	66, 091, 816	74, 174, 424	45. 4	46. 7
Concentrating tables	13	11	2, 929, 389	2, 752, 612	2. 0	1. 8
Jigs in combination with concentrating tables	17	18	4, 321, 871	4, 649, 192	2. 9	2. 9
Jigs in combination with launders and upward-current classifiers	18	19	7, 990, 536	8, 535, 393	5. 5	5. 4
Launders and upward-current classifiers	141	146	43, 041, 163	48, 551, 068	29. 6	30. 6
Total wet methods	403	410	124, 374, 775	138, 662, 689	85. 4	87. 4
Pneumatic methods	83	82	21, 201, 074	20, 064, 440	14. 6	12. 6
Grand total	[1] 486	[1] 492	145, 575, 849	158, 727, 129	100. 0	100. 0

[1] Number of plants using both wet and pneumatic methods was 54 in 1943 and 53 in 1944.

TABLE 37.—*Total production of all coal at bituminous mines in the United States having cleaning plants, in net tons, 1943–44*

[Does not include any estimate for mines that may ship to consumer-operated plants]

Type of equipment	1943	1944	Change, 1944 from 1943 (percent)
Wet methods:			
Jigs	105, 008, 091	111, 163, 648	+5. 9
Concentrating tables	2, 751, 785	2, 026, 953	−26. 3
Jigs in combination with concentrating tables	4, 926, 211	5, 271, 277	+7. 0
Jigs in combination with launders and upward-current classifiers	13, 657, 798	13, 026, 722	−4. 6
Launders and upward-current classifiers	82, 518, 056	87, 864, 211	+6. 5
Total wet methods	208, 861, 941	219, 352, 811	+5. 0
Pneumatic methods	55, 693, 125	54, 578, 526	−2. 0
Grand total	264, 555, 066	278, 931, 337	+3. 5
Less duplication [1]	41, 656, 652	40, 995, 557	−1. 6
Net total	222, 898, 414	232, 935, 780	+4. 5
United States, total production [2]	590, 177, 069	619, 576, 240	+5. 0
Percent produced at mines having cleaning plants	37. 8	37. 6	------------

[1] Mines using both wet and pneumatic methods.
[2] For purposes of historical comparison and statistical convenience, figures include output of lignite and of anthracite and semianthracite outside of Pennsylvania. There are no mechanical cleaning plants at lignite mines.

TABLE 38.—*Method of mining at bituminous-coal mines in the United States served by cleaning plants, 1941–44*

[Does not include any estimate for mines that may ship to consumer-operated plants]

Method of mining in use	Total net tons produced from mines that move coal to cleaning plants [1]				Change 1944 from 1943 (percent)
	1941	1942	1943	1944	
Mined from strip pits	24,773,543	28,597,289	30,326,426	32,444,227	+7.0
Mechanically loaded underground	93,373,789	118,917,178	125,313,683	137,926,900	+10.1
Hand-loaded underground	67,320,837	70,559,424	67,258,305	62,564,653	−7.0
Total	185,468,169	218,073,891	222,898,414	232,935,780	+4.5

[1] Based upon shipping weights and includes some marketable coal that did not pass through cleaning plants.

TABLE 39.—*Bituminous coal mechanically cleaned by wet and pneumatic methods in the United States, by States, 1943–44*

[Coal cleaned and plants operated by consumers at central washeries in Colorado and Pennsylvania included]

State	Plants in operation		Net tons of clean coal		Output mechanically cleaned (percent)	
	1943	1944	1943	1944	1943	1944
Alabama	54	55	13,326,372	14,453,892	77.7	77.1
Alaska	2	2	100,780	188,558	34.8	54.1
Arkansas	2	2	35,638	41,877	2.1	2.1
Colorado	8	8	1,180,248	1,131,259	14.2	13.9
Illinois	53	54	30,321,306	32,965,139	41.7	42.9
Indiana	19	20	9,612,008	11,667,478	38.3	41.7
Kansas	7	5	1,845,362	1,672,834	53.7	49.7
Kentucky	19	20	6,896,774	8,374,636	10.9	11.7
Michigan	1	1	25,290	17,880	15.0	12.8
Missouri	10	11	2,334,203	3,525,474	54.2	73.8
Montana	2	2	146,503	211,692	3.1	4.4
New Mexico	1	2	53,703	95,856	2.9	5.5
Ohio	10	10	6,611,721	6,362,939	20.5	18.8
Oklahoma	2	2	108,942	244,010	3.8	7.6
Pennsylvania [1]	67	63	35,429,650	37,349,752	25.1	25.6
Tennessee	5	4	438,168	350,229	6.1	4.8
Utah	2	3	839,111	2,064,798	12.6	29.0
Virginia	21	20	3,292,751	3,670,435	16.2	18.8
Washington	23	22	1,347,160	1,254,605	88.2	82.3
West Virginia [2]	124	133	31,630,159	33,083,786	19.9	20.1
Total	[3] 432	[4] 439	145,575,849	158,727,129	24.7	25.6

[1] Includes some coal mined in Pennsylvania and cleaned in Ohio and a small tonnage mined in other States and cleaned at a consumer-operated plant in Pennsylvania.
[2] Includes some coal mined in West Virginia and cleaned in Ohio and Pennsylvania.
[3] Represents 54 plants using both wet and pneumatic methods of cleaning and 378 plants using only 1 cleaning method.
[4] Represents 53 plants using both wet and pneumatic methods of cleaning and 386 plants using only 1 cleaning method.

TABLE 40.—*Result of operations at bituminous-coal-cleaning plants in the United States, by States, in net tons, in 1944*

State	Total raw coal moved to cleaning plants	Coal obtained in cleaning process	Refuse resulting in cleaning process	Ratio of refuse to raw coal (percent)	Total production from mines that moved coal to cleaning plants [1]
Alabama	17, 550, 725	14, 453, 892	3, 096, 833	17. 6	15, 683, 257
Alaska	248, 025	188, 558	59, 467	24. 0	188, 558
Arkansas	52, 746	41, 877	10, 869	20. 6	291, 423
Colorado	122, 271	115, 467	6, 804	5. 6	879, 098
Illinois	38, 856, 300	32, 965, 139	5, 891, 161	15. 2	51, 973, 200
Indiana	13, 372, 601	11, 667, 478	1, 705, 123	12. 8	16, 180, 619
Kansas	2, 154, 983	1, 672, 834	482, 149	22. 4	1, 675, 930
Kentucky	9, 824, 300	8, 374, 636	1, 449, 664	14. 8	12, 687, 773
Michigan	22, 350	17, 880	4, 470	20. 0	99, 175
Missouri	4, 240, 885	3, 525, 474	715, 411	16. 9	3, 765, 687
Montana	222, 775	211, 692	11, 083	5. 0	576, 003
New Mexico	102, 517	95, 856	6, 661	6. 5	641, 203
Ohio	8, 332, 560	6, 362, 939	1, 969, 621	23. 6	7, 440, 956
Oklahoma	292, 811	244, 010	48, 801	16. 7	318, 942
Pennsylvania [2]	30, 775, 408	28, 093, 402	2, 682, 006	8. 7	39, 921, 548
Tennessee	390, 172	350, 229	39, 943	10. 2	1, 138, 100
Utah	2, 123, 532	2, 064, 798	58, 734	2. 8	2, 474, 206
Virginia	4, 000, 537	3, 670, 435	330, 102	8. 3	9, 854, 901
Washington	1, 505, 652	1, 254, 605	251, 047	16. 7	1, 341, 965
West Virginia [3]	36, 923, 936	33, 083, 786	3, 840, 150	10. 4	65, 803, 236
Total at mines only [4]	171, 115, 086	148, 454, 987	22, 660, 099	13. 2	232, 935, 780
Consumer plants [5]	10, 956, 307	10, 272, 142	684, 165	6. 2	
Grand total	182, 071, 393	158, 727, 129	23, 344, 264	12. 8	232, 935, 780

[1] Based upon shipping weights and includes some marketable coal that did not pass through cleaning plants.
[2] Includes some coal mined in Pennsylvania and cleaned in Ohio.
[3] Includes some coal mined in West Virginia and cleaned in Ohio and Pennsylvania.
[4] Includes all mechanical cleaning other than washeries operated by consumer steel companies.
[5] Includes central washeries in Colorado and Pennsylvania operated by consumer steel companies.

DETAILED STATISTICS, BY STATES AND COUNTIES

Detailed production and employment statistics are given in table 41 for each coal-producing county in the United States from which three or more operators submitted reports for 1944. Statistics on counties with less than three reporting producers have been combined with data for other counties in the same State to avoid disclosing individual figures, unless permission to publish has been granted by the operators. Production of mines on the border between two States has been credited to the State from which the coal was extracted rather than to that in which the tipple was situated. If the coal is mined from lands in both States, the tonnage has been apportioned accordingly.

In this series the reported production is classified according to the principal methods of distribution or use. Beginning with 1932, the series was expanded to include data on the growing volume of coal moving from mine to consumer by truck. For 1933–36 this tonnage was shown as "Commercial sales by truck or wagon." In 1937 this tonnage was shown as "Truck deliveries, including local sales" (see Minerals Yearbook, 1939, p. 813). In 1938 the truck tonnage was shown as "Shipped by truck or wagon." The truck figures for 1933 to 1936, inclusive, and 1938 to 1944, inclusive, are reasonably comparable.

The data in the present report, as in those published for many years by the Bureau of Mines, relate only to mines with an annual output of 1,000 tons or more. That fact should be borne in mind when the statistics in this report are compared with similar data compiled by State mine departments. Differences arise largely from variations in coverage by State reports, some of which include data for all mines regardless of size and others only data for mines employing more than a specified minimum number, ranging from 2 to 10 men. To meet the administrative demand for statistics on mines with an annual output of less than 1,000 tons per year, data for the small mines are shown in table 42. The average tons per man per day at the small mines was low due to part-time employment, lack of machinery, and difficult working conditions. The production shown in table 42 is not included in the total output shown in other tables for the United States, as this would upset the comparability of the statistical series.

Because of a change in method of reporting, statistics of average production per man per day for 1932 to 1936 and 1938 to 1941 are not precisely comparable with those for other years. For other years they were based upon the calculated number of man-shifts, obtained by multiplying the average number of men employed at each mine by the number of days worked at the mine. From 1932 to 1936 and 1938 to 1941 the operators were asked to make, if possible, a special report of the number of man-shifts actually worked. The number of operators able to furnish this information was small. These reports were utilized to improve the accuracy of the record. Otherwise, the man-shifts were calculated by multiplying the number employed underground and on the surface by the number of days worked by the mine and tipple, respectively.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons): Loaded for shipment by rail or water [1]	Disposition of coal produced (net tons): Shipped by truck or wagon (excluding coal used by mine employees)	Disposition of coal produced (net tons): Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Disposition of coal produced (net tons): Used at mine for power and heat or made into beehive coke at mine	Disposition of coal produced (net tons): Total quantity	Average value per ton [3]	Average number of employees: Underground	Average number of employees: Surface: In strip pits	Average number of employees: Surface: All others	Average number of employees: Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
ALABAMA													
Bibb	822,774	24,680	4,986	19,488	871,928	$4.35	828	----------	264	1,092	287	313,124	2.78
Blount	64,786	97,414	106	1,051	163,357	3.58	210	39	54	303	239	72,356	2.26
Cherokee	----------	2,719	----------	----------	2,719	3.77	5	----------	1	6	215	1,290	2.11
Cullman	562	39,920	20	23	40,525	4.15	88	----------	20	108	198	21,361	1.90
Etowah	----------	2,905	----------	----------	2,905	3.77	3	----------	1	4	280	1,120	2.59
Jackson	3,000	22,281	----------	----------	25,281	3.81	34	----------	8	42	254	10,676	2.37
Jefferson	9,246,229	184,070	79,199	32,538	9,542,036	4.09	9,869	132	1,688	11,689	295	3,451,963	2.76
Marion	222,181	100,179	1,648	----------	324,008	4.58	394	20	87	501	259	129,793	2.50
St. Clair	789,506	35,021	8,426	33,701	866,654	3.81	789	50	325	1,164	246	286,508	3.02
Shelby	411,558	72,433	2,708	922	487,621	4.21	578	----------	115	693	287	199,158	2.45
Tuscaloosa	280,068	83,174	1,833	----------	365,075	3.47	350	26	95	471	266	125,099	2.92
Walker	5,253,461	270,669	481,359	2,153	6,007,642	3.73	4,237	390	942	5,569	280	1,558,349	3.86
Winston	35,673	16,721	20	----------	52,414	4.17	14	32	5	51	204	10,414	5.03
Total Alabama	17,129,798	952,186	580,305	[4] 89,876	18,752,165	3.97	17,399	689	3,605	21,693	285	6,181,211	3.03
ALASKA													
Total Alaska	297,988	27,343	1,215	[4] 21,829	348,375	$6.43	260	----------	81	341	280	95,544	3.65
ARIZONA													
Total Arizona	----------	6,081	----------	----------	6,081	$2.83	19	----------	5	24	116	2,788	2.18

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface: In strip pits	Surface: All others	Total			
ARKANSAS													
Franklin	152,707	7,362	468	1,772	162,309	$4.46	152	47	45	244	218	53,305	3.04
Johnson	424,720	10,310	101		435,131	4.59	309	66	88	463	219	101,262	4.30
Logan	415,200	1,695	2,582	388	419,865	5.79	693		130	823	214	176,070	2.38
Pope	51,948	7,179			59,127	5.24		62	16	78	122	9,529	6.20
Sebastian	865,991	28,746	427	845	896,009	4.20	605	245	177	1,027	213	218,937	4.09
Total Arkansas	1,910,566	55,292	3,578	[4] 3,005	1,972,441	4.67	1,759	420	456	2,635	212	559,103	3.53
COLORADO													
Boulder	286,910	306,602	6,494	4,033	604,039	$3.72	430		89	519	264	137,004	4.41
Delta	80,016	35,039	434	4,727	120,216	3.16	74		14	88	279	24,575	4.89
Elbert		2,077		368	2,445	2.41	3		1	4	221	884	2.77
El Paso	35,154	162,944	21,246	12,907	232,251	2.96	190		43	233	234	54,477	4.26
Fremont	259,067	358,980	3,056	174	621,277	4.02	433		91	524	274	143,638	4.33
Garfield	13,732	40,736	30	1,680	56,178	3.62	37		14	51	268	13,644	4.12
Gunnison	702,665	24,000	9,789	13,528	749,982	3.31	372		109	481	284	136,749	5.48
Huerfano	931,542	64,858	5,522	1,880	1,003,802	3.70	682		189	871	294	256,443	3.91
La Plata	39,789	29,891			69,680	2.57	58		15	73	231	16,873	4.13
Las Animas	1,353,214	51,031	9,843	[5] 169,144	1,583,232	3.76	1,418		279	1,697	280	475,368	3.33
Mesa	78,317	18,861	842	5,765	103,785	2.91	83		17	100	275	27,511	3.77
Moffat	98,713	30,372	9,309		138,394	3.54	50		10	60	275	16,483	8.40
Montrose		22,324	21,087	25	43,436	4.01	28		2	30	295	8,858	4.90
Rio Blanco		11,017	44		11,061	3.54	10		2	12	260	3,118	3.55
Routt	1,104,128	20,682	22,976	39,451	1,187,237	3.81	644	3	224	871	299	260,025	4.57
Weld	1,157,340	290,222	10,666	26,035	1,484,263	3.31	858		178	1,036	233	241,106	6.16
Other counties: Jackson and Jefferson	118,090	35,383	1,071	1,891	156,435	3.01	93	7	21	121	204	24,723	6.33
Total Colorado	6,258,677	1,505,019	122,409	[5] 281,608	8,167,713	3.58	5,463	10	1,298	6,771	272	1,841,479	4.44

GEORGIA

Total Georgia	23,058	922	305	----	24,285	$3.81	72	----	12	84	301	25,264	.96

ILLINOIS

Christian	7,662,301	151,005	40,871	40,059	7,894,236	$1.72	1,777	----	524	2,301	294	676,977	11.66
Clinton	227,583	121,257	2,282	15,721	366,843	2.28	276	----	60	336	218	73,400	5.00
Edgar	----	37,938	----	3,278	41,216	2.48	40	----	5	45	213	9,585	4.30
Franklin	17,271,723	193,650	210,595	214,742	17,890,710	2.42	5,427	----	1,609	7,036	284	1,999,406	8.95
Fulton	7,600,605	335,189	9,167	30,037	7,974,998	2.13	292	390	725	1,407	260	365,963	21.79
Gallatin	26,301	36,955	----	2,412	65,668	2.37	43	----	12	55	236	12,970	5.06
Henry	573,511	83,807	688	453	658,459	2.35	82	46	99	227	277	62,851	10.48
Jackson	2,834,527	126,122	9,209	2,193	2,972,051	1.98	783	50	243	1,076	286	308,174	9.64
Knox	729,819	160,781	2,010	3,858	896,468	2.43	114	33	96	243	266	64,529	13.89
La Salle	53,260	192,707	11,343	683	257,993	3.66	217	26	57	300	197	58,953	4.38
Livingston	----	4,254	78	----	4,332	4.46	----	7	----	7	189	1,320	3.28
Logan	----	51,594	----	----	51,594	3.17	45	----	5	50	236	11,800	4.37
Macon	----	35,159	770	2,221	38,150	4.00	54	----	6	60	204	12,240	3.12
Macoupin	5,176,851	169,372	23,782	148,074	5,518,079	1.85	2,015	----	463	2,478	279	691,961	7.97
Madison	1,115,363	849,512	12,743	71,242	2,048,860	2.22	1,023	----	238	1,261	246	309,863	6.61
Marion	236,344	23,713	1,485	10,640	272,182	2.14	111	----	48	159	263	41,817	6.51
Menard	----	43,184	225	2,576	45,985	2.67	55	----	13	68	223	15,155	3.03
Mercer	----	1,318	----	54	1,372	3.40	5	----	1	6	138	828	1.66
Montgomery	874,588	22,676	2,449	49,600	949,313	1.88	231	----	79	310	297	92,070	10.31
Peoria	327,612	290,418	2,994	784	621,808	2.59	450	----	71	521	236	123,126	5.05
Perry	4,541,355	85,495	12,657	40,148	4,679,655	2.20	877	344	513	1,734	251	435,732	10.74
Randolph	2,470,610	88,208	6,992	38,633	2,604,443	2.13	698	53	292	1,043	254	265,158	9.82
Rock Island	----	1,256	----	----	1,256	3.57	2	----	----	2	230	460	2.73
St. Clair	1,626,558	1,241,565	132,040	60,177	3,060,340	2.19	1,292	97	304	1,693	221	374,731	8.17
Saline	4,433,111	57,171	18,660	54,060	4,563,002	2.54	1,586	95	530	2,211	261	577,490	7.90
Sangamon	2,255,344	608,663	19,258	29,689	2,912,954	2.34	1,979	----	314	2,293	225	517,061	5.63
Schuyler	197,762	56,044	1,952	----	255,758	2.17	22	27	36	85	283	24,061	10.63
Tazewell	----	126,880	36	600	127,516	2.93	102	----	13	115	224	25,714	4.96
Vermilion	2,169,250	252,118	26,071	11,521	2,458,960	2.61	1,497	21	196	1,714	261	447,571	5.49
Warren	----	4,293	----	20	4,313	2.97	4	----	2	6	300	1,800	2.40
Washington	461,695	52,011	3,722	17,026	534,454	2.25	235	----	58	293	255	74,854	7.14
Williamson	4,198,740	362,135	10,173	42,583	4,613,631	2.35	1,401	82	455	1,938	243	471,586	9.78
Other counties:													
Bureau, Grundy, Jefferson, Will, and Woodford	1,949,367	410,247	8,752	36,484	2,404,850	2.63	272	338	300	910	279	254,040	9.47
Total Illinois	69,014,180	6,276,697	571,004	[4] 929,568	76,791,449	2.23	23,007	1,609	7,367	31,983	263	8,403,246	[6] 9.14

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
INDIANA													
Clay	1,676,821	217,188	953	6,421	1,901,383	$2.56	34	316	236	586	230	134,820	14.10
Daviess	26,240	42,583	160	411	69,394	2.51	36	8	11	55	232	12,764	5.44
Dubois	4,646	12,782	30		17,458	2.96	9	12	5	26	141	3,675	4.75
Greene	2,373,056	49,982	1,565	18,664	2,443,267	2.23	312	331	318	961	217	208,212	11.73
Knox	3,443,407	480,413	8,452	25,615	3,957,887	2.15	1,256	56	435	1,747	270	471,998	8.39
Owen	198,491	32	607		199,130	2.50		28	20	48	261	12,512	15.92
Parke		21,318	167	510	21,995	2.65	40		12	52	137	7,138	3.08
Perry		8,284	10	4	8,298	2.42	12		1	13	193	2,513	3.30
Pike	4,143,681	29,420	8,629	15,938	4,197,668	2.03	36	441	479	956	247	235,948	17.79
Spencer	58,894	120,610	350	400	180,254	2.92	21	45	19	85	235	19,934	9.04
Sullivan	2,910,312	99,770	6,455	28,270	3,044,807	2.48	987	234	329	1,550	239	370,735	8.21
Vermillion	407,707	98,348	550	2,630	509,235	2.17	69	82	98	249	197	48,995	10.39
Vigo	4,767,248	361,826	497,825	16,314	5,643,213	2.25	1,837	154	359	2,350	261	613,411	9.20
Warrick	4,147,857	224,086	3,173	585	4,375,701	2.10	334	284	405	1,023	291	297,694	14.70
Other counties:													
Fountain, Gibson, and Vanderburgh	1,035,993	319,715	1,128	35,357	1,392,193	2.66	590	16	110	716	265	189,900	7.33
Total Indiana	25,194,353	2,086,357	530,054	[4] 151,119	27,961,883	2.25	5,573	2,007	2,837	10,417	252	2,630,249	[6] 10.63
IOWA													
Adams		1,423		15	1,438	$5.50	5		1	6	200	1,200	1.20
Appanoose	216,126	129,992	4,349	435	350,902	3.79	644		77	721	175	126,003	2.78
Boone	70,561	36,547	2,016	1,002	110,126	3.98	130		13	143	237	33,933	3.25
Greene		9,632	177	108	9,917	3.68	14		3	17	165	2,805	3.54
Jasper	25	23,979	234		24,238	3.84	25	4	6	35	256	8,971	2.70
Mahaska	114,754	75,081	470	5	190,310	3.38	31	73	43	147	227	33,375	5.70
Marion	287,403	213,069	1,946	1,475	503,893	3.01	300	65	78	443	220	97,307	5.18

Monroe	103,218	68,125	2,612	1,075	175,030	3.25	216		36	252	190	47,998	3.65
Page		6,530			6,530	5.48	28		4	32	159	5,086	1.28
Polk		172,047	3,377	954	176,378	3.94	219		21	240	211	50,548	3.49
Taylor		3,673			3,673	5.33	10		1	11	271	2,985	1.23
Van Buren		31,161	131	40	31,332	3.55	23	7	10	40	260	10,394	3.01
Wapello	123	128,230	299	1,183	129,835	3.41	69	30	22	121	218	26,408	4.92
Webster	2,050	16,117	404		18,571	3.73	19		3	22	251	5,522	3.36
Other counties: Dallas, Guthrie, Keokuk, Lucas, Warren, and Wayne	290,203	114,895	2,609	1,056	408,763	3.65	429	3	60	492	216	106,459	3.84
Total Iowa	1,084,463	1,030,501	18,624	[4] 7,348	2,140,936	3.50	2,162	182	378	2,722	205	558,994	3.83
KANSAS													
Bourbon	190,412	22,620	144	500	213,676	$2.52		49	23	72	228	16,420	13.01
Cherokee	1,310,956	78,489	3,982	2,312	1,395,739	2.47	24	248	154	426	271	115,397	12.10
Crawford	1,564,572	66,026	6,033	2,813	1,639,444	2.53	235	349	147	731	224	164,060	9.99
Franklin		4,444			4,444	5.00	8		1	9	205	1,845	2.41
Labette		5,649	30	1,300	6,979	3.37		9	3	12	142	1,704	4.10
Leavenworth		6,707	37,596	3,682	47,985	5.00	191		56	247	307	75,829	.63
Linn		9,533	5	80	9,618	2.77	19	2	4	25	234	5,839	1.65
Osage		50,890	312		51,202	4.76	134	14	14	162	207	33,482	1.53
Total Kansas [7]	3,065,940	244,358	48,102	[4] 10,687	3,369,087	2.58	611	671	402	1,684	246	414,576	[8] 8.13
KENTUCKY													
Eastern Kentucky:													
Bell	2,759,172	347,131	27,161	3,580	3,137,044	$3.36	2,622		467	3,089	258	797,495	3.93
Boyd	4,033	88,925	287	3,880	97,125	2.85	109	2	21	132	255	33,703	2.88
Breathitt	9,867	42,405	3,987		56,259	3.00	75		17	92	230	21,138	2.66
Carter	59,285	115,556	777	2,599	178,217	2.86	177		48	225	240	54,075	3.30
Clay	173,998	110,662	107		284,767	3.44	415		105	520	223	115,830	2.46
Clinton		16,600			16,600	3.00	26		6	32	261	8,350	1.99
Floyd	7,269,801	163,080	16,378	11,731	7,460,990	3.25	4,753		951	5,704	281	1,603,780	4.65
Greenup		12,162			12,162	2.68	21		2	23	269	6,195	1.96
Harlan	13,360,970	123,891	107,036	8,385	13,600,282	3.40	9,478		1,586	11,064	287	3,178,928	4.28
Jackson		118,451	51	3,876	122,378	3.00	140		41	181	242	43,801	2.79
Johnson	761,901	70,425	5,327	1,858	839,511	3.65	650		118	768	280	215,295	3.90
Knott	716,894	2,247	6,389		725,530	3.08	337	4	107	448	277	124,022	5.85
Knox	622,480	149,552	5,415		777,447	3.23	653		141	794	262	208,171	3.73
Laurel	87,348	231,440	1,329		320,117	3.08	272	65	78	415	211	87,575	3.66
Lawrence	1,860	5,346			7,206	2.13	15		3	18	220	3,952	1.82
Lee	4,259	16,156	50	25	20,490	3.10	35		8	43	225	9,681	2.12
Leslie	202,126	20,156		5	222,287	3.25	182		33	215	275	59,104	3.76

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons): Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity	Average value per ton [3]	Average number of employees: Underground	Surface: In strip pits	Surface: All others	Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
KENTUCKY—Continued													
Eastern Kentucky—Con.													
Letcher	5,895,181	457,055	40,336	9,113	6,401,685	$3.26	4,296		650	4,946	284	1,404,330	4.56
Magoffin	110,119	6,848	24		116,991	3.11	130		24	154	216	33,312	3.51
Martin	505,686	1,591	1,098		508,375	2.81	201		47	248	296	73,290	6.94
McCreary	950,648	75,770	9,369	60	1,035,847	3.10	773		106	879	275	242,018	4.28
Menifee		13,866	77		13,943	2.97	17		2	19	261	4,955	2.81
Perry	5,995,420	19,229	113,671	1,393	6,129,713	3.18	3,655		705	4,360	287	1,252,677	4.89
Pike	8,422,437	497,799	49,262	[9] 99,442	9,068,940	2.96	5,387		1,172	6,559	279	1,832,581	4.95
Pulaski	4,619	139,982	127		144,728	3.01	133	11	18	162	250	40,544	3.57
Rockcastle		31,670	25		31,695	2.61	46		5	51	244	12,460	2.54
Wayne		12,500			12,500	2.63	14		3	17	330	5,602	2.23
Whitley	323,254	203,075	1,572	3,309	531,210	3.32	538	43	140	721	238	171,408	3.10
Wolfe		3,000			3,000	2.92	3		1	4	280	1,120	2.68
Other counties:													
Elliott and Morgan		13,497			13,497	3.23	14	3	3	20	218	4,350	3.10
Total Eastern Kentucky	48,241,358	3,110,067	389,855	[9] 149,256	51,890,536	3.23	35,167	128	6,608	41,903	278	11,649,742	4.45
Western Kentucky:													
Butler		165,812			165,812	2.49	132		30	162	279	45,245	3.66
Christian	22,324	22,564			44,888	2.37	18	12	15	45	224	10,080	4.45
Crittenden		10,400			10,400	2.98	7		2	9	280	2,520	4.13
Daviess	81,400	260,633	390	1,900	344,323	2.23	204	18	48	270	243	65,586	5.25
Edmonson		18,250			18,250	2.32	38		3	41	189	7,755	2.35
Hancock		56,425	100	15	56,540	2.29	43		8	51	266	13,578	4.16
Henderson	13,725	176,688	430	2,684	193,527	2.02	150		36	186	236	43,953	4.40
Hopkins	9,613,449	472,074	37,521	7,159	10,130,203	2.12	2,565	409	878	3,852	264	1,017,970	9.95
McLean	3,077	30,470			33,547	2.55	34		6	40	210	8,419	3.98
Muhlenberg	5,572,754	517,236	17,629	49,609	6,157,228	2.09	2,305	130	618	3,053	276	843,882	7.30
Ohio	428,802	228,449	844	1,784	659,879	2.26	327	87	88	502	234	117,248	5.63

Union	608,003	54,721	100	6,004	668,828	1.99	500	----------	91	591	136	80,490	8.31
Webster	915,377	58,816	100	7,743	982,036	2.06	571	53	115	739	196	144,850	6.78
Total Western Kentucky	17,258,911	2,072,538	57,114	76,898	19,465,461	2.11	6,894	709	1,938	9,541	252	2,401,576	[6] 8.11
Total Kentucky	65,500,269	5,182,605	446,969	[9] 226,154	71,355,997	2.93	42,061	837	8,546	51,444	273	14,051,318	5.08
MARYLAND													
Allegany	788,649	213,591	5,661	686	1,008,587	$3.63	814	52	137	1,003	272	273,233	3.69
Garrett	776,574	77,973	4,246	3,122	861,915	3.19	689	52	137	878	264	231,818	3.72
Total Maryland	1,565,223	291,564	9,907	[4] 3,808	1,870,502	3.43	1,503	104	274	1,881	269	505,051	3.70
MICHIGAN													
Total Michigan	57,779	71,137	2,583	[4] 8,439	139,938	$5.45	146	----------	33	179	278	49,820	2.81
MISSOURI													
Adair	38,074	105,687	275	1,742	145,778	$3.20	188	----------	39	227	221	50,245	2.90
Barton	264,991	45,042	655	78	310,766	2.68	37	65	26	128	219	28,035	11.08
Bates	1,165,864	10,402	1,037	3,152	1,180,455	2.24	9	126	95	230	255	58,700	20.11
Boone	----------	43,474	100	25	43,599	2.74	----------	17	5	22	226	4,965	8.78
Callaway	----------	197,175	29	400	197,604	2.67	----------	77	24	101	302	30,467	6.49
Dade	----------	8,636	50	----------	8,686	3.28	----------	9	----------	9	300	2,700	3.22
Daviess	----------	10,227	----------	----------	10,227	4.62	25	----------	2	27	205	5,535	1.85
Henry	466,560	74,985	50	5,326	546,921	2.25	----------	115	43	158	230	36,360	15.04
Johnson	262,903	32,969	----------	----------	295,872	2.51	----------	50	22	72	269	19,397	15.25
Lafayette	85,949	61,329	4,020	3,265	154,563	3.79	250	3	34	287	262	75,224	2.05
Linn	10,942	21,981	----------	----------	32,923	3.76	100	----------	10	110	179	19,660	1.67
Macon	588,604	67,485	468	----------	656,557	2.35	77	90	96	263	250	65,793	9.98
Moniteau	----------	2,080	----------	----------	2,080	2.85	----------	2	----------	2	298	596	3.49
Monroe	----------	5,371	----------	----------	5,371	3.29	----------	9	----------	9	314	2,826	1.90
Putnam	----------	20,177	220	----------	20,397	3.68	57	----------	10	67	165	11,062	1.84
Randolph	489,697	87,763	207	----------	577,667	2.55	163	61	64	288	251	72,276	7.99
Ray	17,465	78,109	921	36	96,531	4.60	192	----------	23	215	213	45,873	2.10
St. Clair	10,000	4,755	500	350	15,605	2.68	----------	27	4	31	93	2,886	5.41
Vernon	330,671	62,391	1,434	20	394,516	2.57	5	111	20	136	230	31,270	12.62
Other counties: Clay, Harrison, Jasper, and Ralls	----------	79,085	1,651	1,798	82,534	4.29	146	6	16	168	212	35,672	2.31
Total Missouri [7]	3,731,720	1,019,123	11,617	[4] 16,192	4,778,652	2.58	1,249	768	533	2,550	235	599,542	[8] 7.97

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons): Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity	Average value per ton [3]	Average number of employees: Underground	Surface: In strip pits	Surface: All others	Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
MONTANA													
Montana bituminous coal:													
Blaine	------	9,159	30	------	9,189	$4.39	11	------	2	13	297	3,860	2.38
Carbon	597,933	34,176	4,280	928	637,317	3.03	208	------	101	309	266	82,095	7.76
Cascade	452,188	29,734	561	120	482,603	2.00	177	------	28	205	282	57,802	8.35
Chouteau	------	2,613	10	------	2,623	3.89	5	------	------	5	171	856	3.06
Fergus	------	1,016	------	------	1,016	3.45	2	------	------	2	250	500	2.03
Musselshell	1,096,038	38,803	4,924	3,043	1,142,808	2.57	407	------	192	599	279	167,370	6.83
Rosebud	2,510,389	1,209	3,007	------	2,514,605	1.30	2	87	23	112	307	34,388	73.12
Toole	------	2,179	------	------	2,179	2.00	3	------	------	3	250	750	2.91
Total bituminous coal	4,656,548	118,889	12,812	4,091	4,792,340	1.91	815	87	346	1,248	279	347,621	[6] 13.79
Montana lignite	------	[10] 51,709	([10])	------	51,709	2.19	40	7	8	55	173	9,532	5.42
Total Montana	4,656,548	[10] 170,598	[10] 12,812	[4] 4,091	4,844,049	1.92	855	94	354	1,303	274	357,153	[6] 13.56
NEW MEXICO													
Bernalillo	------	3,573	20	------	3,593	$4.37	6	------	1	7	160	1,120	3.21
Colfax	1,115,648	7,761	5,127	3,270	1,131,806	3.37	611	------	161	772	295	227,921	4.97
McKinley	409,476	42,237	3,356	30,632	485,701	4.65	522	------	169	691	265	182,844	2.66
Rio Arriba	16,771	3,154	24	------	19,949	3.38	19	------	5	24	222	5,329	3.74
Sandoval	------	6,573	------	------	6,573	3.73	15	------	5	20	163	3,260	2.02
San Juan	------	13,841	------	------	13,841	3.61	49	------	5	54	129	6,960	1.99
Other countries:													
Santa Fe and Socorro	47,846	24,386	45	9,934	82,211	4.60	129	------	44	173	302	52,173	1.58
Total New Mexico	1,589,741	101,525	8,572	[4] 43,836	1,743,674	3.79	1,351	------	390	1,741	275	479,607	3.64

NORTH DAKOTA (LIGNITE)

Total North Dakota	1,864,870	411,552	[10] 59,671	[4] 29,999	2,366,092	$1.49	292	254	280	826	213	175,562	[6] 13.48
OHIO													
Athens	2,245,468	70,043	11,683	7,715	2,334,909	$2.94	1,430	46	372	1,848	260	480,798	4.86
Belmont	8,552.705	254,512	30,385	14,782	8,852,384	2.67	4,425	212	837	5,474	281	1,536,406	5.76
Carroll	229,727	218,046	1,842	8	449,623	2.80	223	47	40	310	263	81,587	5.51
Columbiana	180,408	711,893	122	105	892,528	2.59	150	134	106	390	246	96,043	9.29
Coshocton	39,110	313,682	849	1,961	355,602	2.71	242	26	61	329	228	74,911	4.75
Gallia	37,541	92,204	---	8	129,753	2.91	136	6	30	172	219	37,716	3.44
Guernsey	562,113	110,067	1,605	1,211	674,996	2.72	468	6	57	531	269	142,951	4.72
Harrison	6,448,211	54,792	3,301	15,196	6,521,500	2.53	1,077	514	587	2,178	290	631,685	10.32
Hocking	479,520	89,857	539	2	569,918	2.83	374	72	90	536	214	114,909	4.96
Holmes	---	18,289	46	3	18,338	2.78	12	20	4	36	137	4,942	3.71
Jackson	91,246	96,185	17,922	---	205,353	3.38	198	27	43	268	216	57,972	3.54
Jefferson	5,160,485	671,855	13,373	6,085	5,851,798	2.65	1,787	368	720	2,875	260	748,675	7.82
Lawrence	6,044	76,738	250	175	83,207	2.32	108	---	17	125	227	28,363	2.93
Mahoning	87,767	200,483	803	1,980	291,033	2.95	23	79	20	122	226	27,611	10.54
Meigs	327,792	73,732	175	---	401,699	2.69	294	---	74	368	233	85,648	4.69
Morgan	362,174	19,228	---	---	381,402	2.71	164	22	46	232	271	62,875	6.07
Muskingum	1,747,576	220,691	749	379	1,969,395	2.36	677	70	155	902	269	242,194	8.13
Noble	227,907	14,627	---	50	242,584	2.02	105	26	26	157	163	25,588	9.48
Perry	1,226,699	216,362	2,108	296	1,445,465	2.83	676	189	202	1,067	218	233,066	6.20
Portage	---	94,013	---	---	94,013	2.63	---	17	5	22	309	6,807	13.81
Stark	3,582	323,607	246	319	327,754	2.73	40	117	44	201	200	40,159	8.16
Tuscarawas	153,358	1,472,452	775	336	1,626,921	2.52	532	192	131	855	251	214,589	7.58
Vinton	83,403	58,751	270	113	142,537	2.72	66	39	23	128	228	29,209	4.88
Wayne	---	14,343	---	---	14,343	2.09	---	8	---	8	117	936	15.32
Total Ohio	28,252,836	5,486,452	87,043	[4] 50,724	33,877,055	2.65	13,207	2,237	3,690	19,134	262	5,005,640	[6] 6.77
OKLAHOMA													
Coal	206,940	35,713	267	12	242,932	$4.10	39	82	47	168	188	31,546	[8] 7.70
Haskell	149,922	1,683	862	1,100	153,567	3.46	176	20	87	283	282	79,890	1.92
Latimer	29,996	3,425	145	---	33,566	4.07	71	---	21	92	154	14,212	2.36
Le Flore	400,474	18,306	879	1,792	421,451	4.65	548	---	121	669	205	136,843	3.08
Muskogee	179,205	2,789	---	---	181,994	2.94	4	48	17	69	261	18,010	[8] 10.11
Okmulgee	580,768	40,731	76	1,636	623,211	3.42	376	---	61	437	294	128,560	4.85
Pittsburg	353,852	12,000	690	5,617	372,159	4.44	381	36	102	519	285	147,990	2.51
Rogers	453,916	31,196	86	6,841	492,039	2.66	---	100	59	159	266	42,329	11.62
Tulsa	27,383	6,914	805	300	35,402	3.34	30	20	15	65	212	13,765	2.57
Other counties:													
Craig and Wagoner	612,572	39,581	8	52	652,213	2.71	---	98	61	159	245	38,909	[8] 16.76
Total Oklahoma	2,995,028	192,338	3,818	[4] 17,350	3,208,534	3.47	1,625	404	591	2,620	249	652,054	4.92

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface: In strip pits	Surface: All others	Total			
OREGON													
Total Oregon		1,453			1,453	$6.00	8		2	10	140	1,400	1.04
PENNSYLVANIA (BITUMINOUS COAL)													
Allegheny	14,649,536	2,574,274	1,332,784	4,400	18,560,994	$2.95	8,240	685	1,505	10,430	289	3,011,225	6.16
Armstrong	5,695,112	147,903	46,630	660	5,890,305	3.05	3,097	220	573	3,890	282	1,096,745	5.37
Beaver	46,346	292,643	252	83	339,324	2.93	114	65	39	218	279	60,728	5.59
Bedford	634,428	92,184	122,304	466	849,382	3.83	709	57	120	886	256	226,936	3.74
Blair	46,275	73,369	922		120,566	3.59	120		17	137	276	37,775	3.19
Bradford		4,026			4,026	3.80	6	6	1	13	71	923	4.36
Butler	742,076	453,177	21,567	650	1,217,470	3.20	613	179	170	962	249	239,647	5.08
Cambria	16,773,238	680,067	1,774,067	[11] 249,534	19,476,906	3.44	12,358	408	2,592	15,358	290	4,454,069	4.37
Cameron		3,236			3,236	2.20		5		5	280	1,400	2.31
Centre	1,120,667	263,019	965	213	1,384,864	3.14	797	139	175	1,111	257	285,859	4.84
Clarion	3,031,434	339,208	35,819	90	3,406,551	2.83	970	591	351	1,912	252	482,498	[8] 7.06
Clearfield	6,042,309	336,587	19,536	24,160	6,422,592	3.23	2,870	1,126	890	4,886	248	1,211,029	5.30
Clinton	174,370	72,190	143	552	247,255	3.11	53	105	37	195	226	44,162	[8] 5.60
Elk	510,177	138,285	6,467	19,960	674,889	3.11	534		110	644	288	185,535	3.64
Fayette	17,344,853	2,021,109	188,709	[11] 4,732,013	24,286,684	3.19	13,527	409	1,997	15,933	291	4,634,483	5.24
Greene	7,255,679	39,291	17,383	16,956	7,329,309	3.07	3,913	123	828	4,864	272	1,321,680	5.55
Huntingdon	347,504	137,826	4,645	2,958	492,933	3.82	419	74	90	583	264	153,670	3.21
Indiana	9,549,702	337,515	345,914	[11] 389,593	10,622,724	3.10	5,035	463	1,046	6,544	283	1,851,297	5.74
Jefferson	2,099,754	208,554	2,973	4,524	2,315,805	3.04	1,385	299	266	1,950	244	475,355	4.87
Lawrence		87,222	78	10	87,310	2.88	30	32	23	85	171	14,521	[8] 6.01
Lycoming	3,000	46,067	60		49,127	3.25	38	6	9	53	270	14,308	3.43
Mercer	388,546	182,972	1,772	24	573,314	2.80	99	65	29	193	262	50,644	[8] 11.32
Somerset	7,467,684	193,209	21,247	48,071	7,730,211	3.33	4,385	410	981	5,776	278	1,605,878	4.81
Tioga	176,038	94,375	335	661	271,409	3.79	185	31	43	259	248	64,306	4.22
Venango	58,536	60,498	30		119,064	2.94	10	36	16	62	174	10,814	[8] 11.01

Washington	20,084,000	550,382	322,928	50,362	21,007,672	3.09	11,044	681	2,092	13,817	290	4,001,727	5.25
Westmoreland	9,595,539	1,410,189	230,955	[11] 1,325,152	12,561,835	2.99	5,914	522	1,065	7,501	283	2,123,406	5.92
Other counties:													
Forest and McKean	----------	6,658	----------	----------	6,658	3.10	6	----------	2	8	251	2,010	3.31
Total Pennsylvania	123,836,803	10,846,035	4,498,485	[11] 6,871,092	146,052,415	3.15	76,471	6,737	15,067	98,275	281	27,662,630	5.28
SOUTH DAKOTA (LIGNITE)													
Total South Dakota	([10])	[10] 26,733	[19] 94	([10])	26,827	$2.05	6	20	2	28	177	4,954	5.42
TENNESSEE													
Anderson	1,319,146	2,752	10,174	160	1,332,232	$3.20	853	9	154	1,016	286	290,211	4.59
Campbell	1,625,927	43,072	32,812	1,006	1,702,817	3.50	1,283	16	269	1,568	272	426,710	3.99
Claiborne	1,651,750	37,657	19,565	150	1,709,122	3.19	1,223	----------	226	1,449	270	390,664	4.37
Cumberland	----------	10,850	150	550	11,550	2.54	15	----------	4	19	222	4,226	2.73
Fentress	350,629	36,816	2,199	1,783	391,427	2.87	231	14	48	293	263	76,992	5.08
Grundy	481,857	4,132	9,860	805	496,654	3.32	400	----------	52	452	275	124,305	4.00
Hamilton	71,812	21,743	50	124	93,729	2.80	80	10	17	107	202	21,663	4.33
Marion	652,546	79,463	6,382	1,562	739,953	3.56	781	5	175	961	245	235,470	3.14
Morgan	106,161	35,395	1,962	13,839	157,357	2.19	175	16	39	230	236	54,293	2.90
Overton	131,710	784	17,534	317	150,345	3.01	130	----------	19	149	278	41,428	3.63
Putnam	38,094	25,693	----------	----------	63,787	3.24	55	----------	12	67	263	17,621	3.62
Scott	188,275	5,577	499	15	194,366	3.05	163	14	36	213	241	51,282	3.79
Sequatchie	61,586	70,784	531	423	133,324	3.32	173	----------	24	197	231	45,434	2.93
White	----------	8,072	----------	----------	8,072	2.67	11	----------	1	12	180	2,160	3.74
Other counties:													
Bledsoe and Rhea	52,810	27,416	1,086	----------	81,312	3.23	101	----------	16	117	226	26,496	3.07
Total Tennessee	6,732,303	410,206	102,804	[4] 20,734	7,266,047	3.26	5,674	84	1,092	6,850	264	1,808,955	4.02
TEXAS (LIGNITE)													
Total Texas	106,378	1,399	[10] 1,755	([10])	109,532	$0.87	3	22	11	36	198	7,128	[8] 15.37

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons): Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity	Average value per ton [3]	Average number of employees: Underground	Surface: In strip pits	Surface: All others	Total	Average number of days mines were active	Number of man-days worked	Average tons per man per day
UTAH													
Carbon	4,692,143	137,111	20,209	[12] 21,500	4,870,963	$3.14	1,809		728	2,537	301	763,163	6.38
Emery	2,019,686	126,691	3,373	10,087	2,159,837	2.99	912		270	1,182	305	361,070	5.98
Grand	43,484	1,036	215		44,735	3.03	27		7	34	246	8,352	5.36
Iron		7,477			7,477	2.96	7			7	236	1,650	4.53
Kane		1,436			1,436	3.62	4			4	90	360	3.99
Uintah		1,140			1,140	4.00	6		2	8	250	2,000	.57
Other counties:													
Sevier and Summit	2,550	30,946	175	2	33,673	2.59	22		8	30	208	6,250	5.39
Total Utah	6,757,863	305,837	23,972	[12] 31,589	7,119,261	3.09	2,787		1,015	3,802	301	1,142,845	[13] 6.23
VIRGINIA													
Buchanan	5,887,235	17,466	16,021	1,791	5,922,513	$3.19	3,505	30	459	3,994	302	1,205,668	4.91
Dickenson	1,659,906	3,869	11,140	1,443	1,676,358	3.08	1,392		192	1,584	295	467,535	3.59
Lee	859,025	60,585	10,887	566	931,063	3.39	869		133	1,002	251	251,666	3.70
Russell	1,120,294	83,114	11,835	1,156	1,216,399	3.09	952		125	1,077	295	317,476	3.83
Tazewell	4,622,987	3,280	39,569	14,034	4,679,870	3.58	3,359		760	4,119	302	1,244,233	3.76
Wise	4,354,185	77,793	30,060	[14] 404,168	4,866,206	3.00	3,598	32	611	4,241	289	1,223,866	3.98
Other counties:													
Montgomery and Scott	173,008	43,145	4,662	650	221,465	2.93	193		65	258	265	68,398	3.24
Total Virginia	18,676,640	289,252	124,174	[14] 423,808	19,513,874	3.23	13,868	62	2,345	16,275	294	4,778,842	4.08

WASHINGTON

King	160,217	294,671	2,913	5	457,806	$5.41	408	9	114	531	293	155,431	2.95
Kittitas	657,087	30,670	38,764	12,664	739,185	4.57	504	16	193	713	300	214,147	3.45
Lewis	30,731	51,497	309	120	82,657	4.20	76	8	19	103	248	25,511	3.24
Pierce	39,398	9,352	162	40	48,952	5.37	83	----------	14	97	268	25,954	1.89
Thurston	45,445	14,086	422	----------	59,953	3.58	36	----------	11	47	302	14,186	4.23
Whatcom	98,199	32,981	732	3,676	135,588	5.02	105	----------	29	134	303	40,536	3.34
Total Washington	1,031,077	433,257	43,302	[4] 16,505	1,524,141	4.83	1,212	33	380	1,625	293	475,765	3.20

WEST VIRGINIA

Barbour	2,653,239	7,473	6,703	40	2,667,455	$2.57	1,008	310	273	1,591	253	402,115	6.63
Boone	4,926,798	17,677	29,255	740	4,974,470	3.05	2,512	12	578	3,102	283	879,317	5.66
Braxton	9,749	10,648	24	----------	20,421	2.61	33	----------	7	40	167	6,695	3.05
Brooke	1,030,969	380,288	1,001,061	105	2,412,423	2.59	762	205	156	1,123	264	296,351	[6] 8.14
Clay	1,051,657	13,681	13,305	27,081	1,105,724	3.12	546	10	186	742	293	217,766	5.08
Fayette	13,044,084	99,591	457,380	[15] 259,516	13,860,571	3.35	8,170	368	1,654	10,192	294	2,992,352	4.63
Gilmer	11,171	3,630	----------	----------	14,801	2.59	7	8	6	21	135	2,832	5.23
Grant	----------	34,842	161	137	35,140	3.31	53	----------	7	60	252	15,114	2.32
Greenbrier	2,732,562	75,715	12,484	422	2,821,183	3.41	1,503	222	291	2,016	274	552,589	5.11
Hancock	1,562	122,532	85	1,352	125,531	2.58	5	28	9	42	240	10,060	[8] 12.48
Harrison	12,852,817	88,566	65,907	152	13,007,442	2.59	2,620	1,624	1,143	5,387	246	1,323,136	[6] 9.83
Kanawha	8,187,572	211,219	50,822	8,494	8,458,107	3.08	4,936	----------	892	5,828	291	1,695,113	4.99
Lewis	----------	14,636	783	1	15,420	3.01	21	----------	2	23	181	4,170	3.70
Lincoln	----------	1,525	15	260	1,800	3.00	3	----------	2	5	150	750	2.40
Logan	23,316,307	9,474	142,740	31,785	23,500,306	2.93	9,216	----------	2,498	11,714	298	3,492,970	[13] 6.73
Marion	10,295,809	91,422	448,955	33,545	10,869,731	2.68	4,738	86	1,202	6,026	285	1,718,893	[6] 6.32
Marshall	713,530	113,889	228,496	13,777	1,069,692	2.86	606	9	95	710	299	212,351	5.04
Mason	125,018	121,117	304	----------	246,439	2.84	133	----------	14	147	272	39,974	6.16
McDowell	24,968,505	82,180	325,401	86,431	25,462,517	3.13	14,541	22	3,190	17,753	302	5,357,426	4.75
Mercer	3,212,576	16,077	33,211	467	3,262,331	3.45	2,063	----------	596	2,659	299	795,107	4.10
Mineral	139,430	25,634	190	----------	165,254	3.76	185	----------	37	222	221	49,026	3.37
Mingo	5,576,877	23,919	41,004	844	5,642,644	3.05	2,880	27	634	3,541	286	1,013,296	5.57
Monongalia	11,434,611	184,738	13,877	[15] 81,142	11,714,368	2.54	3,737	119	1,121	4,977	292	1,453,197	[6] 8.06
Nicholas	1,037,635	25,597	4,494	[15] 30,459	1,098,185	2.92	701	61	108	870	271	235,683	4.66
Ohio	1,531,887	267,808	11,684	20	1,811,399	2.93	1,144	10	174	1,328	296	393,607	4.60
Preston	1,669,673	14,409	119,115	[15] 173,880	1,977,077	2.93	1,157	159	312	1,628	267	435,459	4.54
Putnam	200	11,142	----------	----------	11,342	3.22	18	----------	6	24	165	3,954	2.87
Raleigh	15,669,599	72,438	134,626	56,830	15,933,493	3.33	9,441	81	2,024	11,546	295	3,405,792	4.68
Randolph	1,976,515	67,839	8,452	20,210	2,073,016	2.96	951	185	384	1,520	252	383,580	5.40
Taylor	1,122,932	231,325	1,686	----------	1,355,943	2.76	533	109	117	759	246	186,976	[6] 7.25
Tucker	624,072	3,640	4,705	29,092	661,509	3.42	450	----------	55	505	303	153,206	4.32
Upshur	485,342	65,730	778	3,921	555,771	2.59	257	11	81	349	272	94,858	5.86
Wayne	314,645	16,966	12	----------	331,623	2.94	236	----------	54	290	246	71,390	4.65
Webster	1,828,250	4,615	6,962	313	1,840,140	3.27	943	----------	211	1,154	290	334,387	5.50
Wyoming	5,530,718	9,541	38,822	21,421	5,600,502	3.38	3,321	----------	703	4,024	287	1,155,020	4.85
Total West Virginia	158,076,311	2,541,523	3,203,499	[15] 882,437	164,703,770	3.01	79,430	3,666	18,822	101,918	288	29,384,512	5.61

See footnotes at end of table.

TABLE 41.—*Production, value, employment, days active, man-days, and output per man per day at bituminous-coal and lignite mines in the United States, by States and counties, in 1944*—Continued

[Exclusive of mines producing less than 1,000 tons]

County	Disposition of coal produced (net tons)					Average value per ton [3]	Average number of employees				Average number of days mines were active	Number of man-days worked	Average tons per man per day
	Loaded for shipment by rail or water [1]	Shipped by truck or wagon (excluding coal used by mine employees)	Used by mine employees, taken by locomotive tenders at tipple, or other uses at mine [2]	Used at mine for power and heat or made into beehive coke at mine	Total quantity		Underground	Surface		Total			
								In strip pits	All others				
WYOMING													
Campbell	185,464	26,788	625	8,381	221,258	$2.13	----------	20	31	51	173	8,810	25.11
Carbon	1,245,885	16,620	3,848	27,194	1,293,547	2.57	257	65	129	451	310	140,001	9.24
Converse	----------	14,381	----------	240	14,621	2.43	1	7	1	9	208	1,874	7.80
Fremont	----------	10,115	30	35	10,180	3.43	10	----------	6	16	234	3.740	2.72
Hot Springs	125,674	28,428	45	1,176	155,323	4.17	110	----------	34	144	263	37,890	4,10
Johnson	----------	9,493	80	20	9,593	2.99	7	----------	3	10	250	2,495	3.84
Lincoln	532,818	7,701	3,066	381	543,966	3.05	269	----------	74	343	294	100,684	5.40
Sheridan	1,105,906	32,869	2,133	1,914	1,142,822	2.28	251	33	92	376	246	92,478	12.36
Sweetwater	6,033,992	11,232	32,914	58,841	6,136,979	2.74	2,467	----------	609	3,076	333	1,025,102	5.99
Uinta	4,752	4,100	----------	----------	8,852	3.07	11	----------	2	13	240	3,120	2.84
Other counties: Natrona and Teton	----------	2,871	----------	----------	2,871	2.91	5	----------	2	7	302	2,114	1.36
Total Wyoming	9,234,491	164,598	42,741	[4] 98,182	9,540,012	2.69	3,388	125	983	4,496	315	1,418,308	[6] 6.73

UNITED STATES

Total United States	558,644,903	40,131,943	10,559,414	10,239,980	619,576,240	$2.92	301,461	21,035	70,851	393,347	278	109,273,540	5.67

[1] Includes coal loaded at mine directly into railroad cars or river barges, hauled by truck to railroad siding for shipment by rail, and hauled by truck to waterway for shipment by water.

[2] Includes coal transported from mine to point of use by conveyor or tram.

[3] Value received or charged for coal, f. o. b. mine, including selling cost. (Includes a value for coal not sold but used by producer, such as mine fuel and coal coked [not coke] as estimated by producer at average prices that might have been received if such coal had been sold commercially.)

[4] No coal was "Made into beehive coke at mine."

[5] Includes 149,908 tons "Made into beehive coke at mine" in Las Animas County.

[6] Output obtained chiefly from strip pits and by use of mechanical loading devices, in which types of operation production per man per day is large.

[7] Production of Alston Coal Co. (Alston mine) is credited to Missouri.

[8] Output obtained chiefly from strip pits in which production per man per day is large.

[9] Includes 92,764 tons "Made into beehive coke at mine" in Pike County.

[10] In Montana some lignite included in "Shipped by truck or wagon" includes "Other uses at mine." In North Dakota some lignite made into briquets is included in "Other uses at mine." In South Dakota some lignite "Loaded for shipment by rail or water" is included in "Shipped by truck or wagon." In South Dakota and Texas some lignite "Used at mine for power and heat" is included in "Used by mine employees."

[11] Includes coal "Made into beehive coke at mine" in following counties: Cambria, 47,375 tons; Fayette, 4,713,263; Indiana, 284,698; and Westmoreland, 1,301,323—grand total, 6,346,659 tons.

[12] Includes 15,082 tons "Made into beehive coke at mine" in Carbon County.

[13] Output is obtained chiefly by use of mechanical loading devices in which type of operation production per man per day is large.

[14] Includes 397,105 tons "Made into beehive coke at mine" in Wise County.

[15] Includes coal "Made into beehive coke at mine" in following counties: Fayette, 244,847 tons; Monongalia, 80,707; Nicholas, 30,358; Preston, 169,477—grand total, 525,389 tons.

717372—47——58

SUMMARY OF SMALL MINES

TABLE 42.—*Summary of data on mines in the United States producing less than 1,000 tons a year, by States and districts, in 1944* [1]

[Figures compiled from schedules actually received and supplemented by State Mine Inspectors' Reports where available. Not possible to obtain complete coverage. Data shown in table not included in other parts of this report]

State or district	Number of active mines	Total production (net tons)	Average value per ton	Average number of employees	Average number of days mines were active	Number of man-days worked	Average tons per man per day
STATES							
Alabama	45	19,221	$3.65	132	82	10,806	1.78
Arizona	1	570	5.51	2	240	480	1.19
Arkansas	38	14,384	4.51	148	108	16,045	.90
California	1	119	2.50	3	208	624	.19
Colorado	69	28,430	3.55	134	122	16,281	1.75
Idaho	1	358	3.68	2	136	272	1.32
Illinois	68	27,224	2.60	206	74	15,242	1.79
Indiana	40	17,938	2.74	90	107	9,602	1.87
Iowa	29	12,954	3.44	96	73	7,023	1.84
Kansas	28	12,609	3.76	110	71	7,776	1.62
Kentucky	401	178,282	2.90	1,033	84	86,758	2.05
Maryland	55	22,760	3.25	131	93	12,174	1.87
Missouri	78	31,029	3.59	231	104	23,978	1.29
Montana	24	8,461	3.58	37	128	4,720	1.79
New Mexico	21	9,420	3.53	55	140	7,693	1.22
Ohio	253	94,236	2.71	449	106	47,587	1.98
Oklahoma	28	13,121	4.39	98	96	9,364	1.40
Oregon	3	1,315	4.78	8	88	703	1.87
Pennsylvania	295	137,910	2.84	670	96	64,492	2.14
Tennessee	33	13,686	2.89	81	111	8,957	1.53
Utah	12	4,323	3.39	27	100	2,698	1.60
Virginia	24	10,922	3.26	65	91	5,884	1.86
Washington	15	5,001	5.03	38	84	3,200	1.56
West Virginia	236	81,838	2.68	517	71	36,473	2.24
Wyoming	23	10,196	3.12	45	108	4,850	2.10
Total	1,821	756,307	3.03	4,408	92	403,682	1.87
PRODUCING DISTRICTS [2]							
Dist. 1. Eastern Pennsylvania	257	118,887	2.93	578	97	56,066	2.12
2. Western Pennsylvania	101	44,253	2.81	236	92	21,598	2.05
3. Northern West Virginia	100	38,178	2.45	215	70	15,120	2.53
4. Ohio	253	94,236	2.71	449	106	47,587	1.98
5. Michigan	--	--	--	--	--	--	--
6. Panhandle	9	2,452	2.75	13	63	817	3.00
7. Southern numbered 1	34	15,623	3.16	95	74	7,000	2.23
8. Southern numbered 2	498	206,023	2.92	1,266	82	103,962	1.98
9. West Kentucky	31	13,680	2.46	61	107	6,528	2.10
10. Illinois	68	27,224	2.60	206	74	15,242	1.79
11. Indiana	40	17,938	2.74	90	107	9,602	1.87
12. Iowa	29	12,954	3.44	96	73	7,023	1.84
13. Southeastern	59	25,523	3.47	165	88	14,453	1.77
14. Arkansas-Oklahoma	48	20,515	4.40	192	105	20,205	1.02
15. Southwestern	124	50,628	3.78	395	94	36,958	1.37
16. Northern Colorado	4	1,738	3.54	9	102	920	1.89
17. Southern Colorado	69	29,692	3.58	136	131	17,863	1.66
18. New Mexico	19	7,109	3.58	49	128	6,295	1.13
19. Wyoming	24	10,554	3.14	47	109	5,122	2.06
20. Utah	12	4,323	3.39	27	100	2,698	1.60
22. Montana	24	8,461	3.58	37	128	4,720	1.79
23. Washington and Oregon	18	6,316	4.98	46	85	3,903	1.62
Total	1,821	756,307	3.03	4,408	92	403,682	1.87

[1] Data on small lignite mines in Montana, North Dakota, South Dakota, and Texas not available.
[2] For boundaries of districts, see Bituminous Coal Act of 1937 and modifications thereto.

STATISTICS ON LIGNITE IN 1944[3]

PRODUCTION

The production of lignite in 1944 totaled 2,554,160 net tons, exclusive of some small mines that produced less than 1,000 tons—a decrease of 7.1 percent from the 2,749,393 tons produced in 1943. The average value per ton—$1.49—is the same as in 1943. The total employees in 1944 numbered 945 against 1,165 in 1943, while the average output per man per day for the same periods, based upon calculated man-days, was 12.95 and 10.98 tons, respectively. The output per man per day is high in the lignite industry compared with other coal mining in the United States because a large part of the total production (70 percent in 1944) is recovered from strip pits where the average output per man per day is much higher than in deep mining.

As for many years in the past, North Dakota was the chief producer of lignite in 1944, followed in order by Texas, Montana, and South Dakota. The North Dakota output comprised 93 percent of the total production, that of Texas 4 percent, and that of South Dakota and Montana taken together, 3 percent.

TABLE 43.—*Summary of production, value, men employed, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1944, by States* [1]

	Montana [2]	North Dakota	South Dakota	Texas	Total
Production (net tons):					
Loaded at mine for shipment		1,864,870	(3)	106,378	1,971,248
Commercial sales by truck or wagon	[4] 51,709	411,552	[3] 26,733	1,399	491,393
Used by employees, taken by locomotives at tipple, and other uses	(4)	[5] 59,671	[6] 94	[6] 1,755	61,520
Used at mine for power and heat		29,999	(6)	(6)	29,999
Total production: 1944	51,709	2,366,092	26,827	109,532	2,554,160
1943	64,383	2,500,202	40,664	144,144	2,749,393
Value:					
Total: 1944	$113,000	$3,535,000	$55,000	$95,000	$3,798,000
1943	$139,000	$3,752,000	$78,000	$127,000	$4,096,000
Average per ton: 1944	$2.19	$1.49	$2.05	$0.87	$1.49
1943	$2.16	$1.50	$1.92	$0.88	$1.49
Number of employees:					
Underground	40	292	6	3	341
Surface (including strip pits)	15	534	22	33	604
Total employees: 1944	55	826	28	36	945
1943	66	1,002	29	68	1,165
Average number of days mines operated:					
1944	173	213	177	198	209
1943	182	223	203	129	215
Man-days of labor: 1944 [7]	9,532	175,562	4,954	7,128	197,176
Average output (tons) per man per day: 1944 [7]	5.42	13.48	5.42	15.37	12.95

[1] Includes many small mines producing less than 1,000 tons.
[2] Includes output of Custer, Dawson, McCone, Richland, Roosevelt, Sheridan, and Valley Counties.
[3] Some "Loaded at mine for shipment" included in "Commercial sales by truck or wagon."
[4] Some "Other uses" included in "Commercial sales by truck or wagon."
[5] Includes some lignite made into briquets.
[6] Some "Colliery fuel" included in "Other uses."
[7] Based upon calculated man-days.

[3] Compiled by J. A. Corgan and M. I. Cooke.

The number of lignite mines reporting production to the Bureau of Mines in 1944 totaled 108 compared with 131 in 1943 and 173 in 1942. Many of the producers indicated on their reports that the mines were closed because of insufficient labor to operate them. It is not expected that many more mines will be in operation in 1945; however, the number should increase in 1946, when it is believed that labor will be more plentiful.

According to the Federal Power Commission, 623,712 tons of lignite were consumed in the West North Central States for generating electric energy in 1944; 795 tons in the West South Central States; and 376,551 tons, a large part of which was subbituminous, in the Mountain States.

The Bureau of Mines prepared this report from an annual canvass of operators of lignite properties included in the areas mapped as "lignite" in Geological Survey Professional Paper 100-A, The Coal Fields of the United States. Subbituminous coal is not included. The data on individual operations are voluntary and confidential, as is customary in the statistical surveys of the Bureau.

TABLE 44.—*Production, value, men employed, days operated, man-days of labor, and output per man per day at lignite mines in the United States in 1944, by States and counties*

County	Total production (net tons)	Value: Total (thousand dollars)	Value: Average per ton	Total number of employees	Man-days of labor [1]	Average number of days mine operated	Average tons per man per day [1]
MONTANA							
Custer	15,783	36	$2.28	15	3,000	200	5.26
Dawson and Valley	4,674	11	2.35	10	1,412	141	3.31
McCone, Richland, and Roosevelt	13,096	27	2.06	13	2,380	183	5.50
Sheridan	18,156	39	2.15	17	2,740	161	6.63
Total, Montana	51,709	113	2.19	55	9,532	173	5.42
NORTH DAKOTA							
Adams	89,131	168	$1.88	53	6,325	119	[2] 14.09
Bowman, Burke, and Divide	597,413	880	1.47	124	25,504	206	[2] 23.42
Burleigh	285,927	383	1.34	87	18,367	211	[2] 15.57
Dunn	6,939	17	2.45	12	1,463	122	4.74
Grant	17,232	43	2.50	15	1,942	129	8.87
Hettinger	13,130	32	2.44	21	2,625	125	5.00
McKenzie	3,994	11	2.75	7	856	122	4.67
McLean and Mountrail	11,770	27	2.29	16	1,472	92	8.00
Mercer	608,351	853	1.40	192	51,187	267	[2] 11.88
Morton	26,560	61	2.30	27	4,304	159	6.17
Oliver and Slope	5,290	12	2.27	13	935	72	5.66
Stark	99,429	149	1.50	78	19,012	244	5.23
Ward	590,498	873	1.48	160	39,186	245	[2] 15.07
Williams	10,428	26	2.49	21	2,384	114	4.37
Total, North Dakota	2,366,092	3,535	1.49	826	175,562	213	13.48
SOUTH DAKOTA							
Carson, Dewey, and Meade	22,887	45	$1.97	20	4,052	203	5.66
Harding and Perkins	3,940	10	2.54	8	902	113	4.37
Total, South Dakota	26,827	55	2.05	28	4,954	177	5.42
TEXAS							
Total Texas: Milam, Titus, and Wood	109,532	95	$0.87	36	7,128	198	15.37

[1] Based upon "calculated" man-days.
[2] Output is obtained chiefly from strip pits in which the production per man per day is large.

METHODS OF RECOVERY

TABLE 45.—*Lignite mined by different methods in the United States in 1944, by States, in net tons*

State	Mined by hand	Shot off the solid	Cut by machines [1]	From strip pits	Total
Montana and Texas	(2)	[2] 55,573		105,668	161,241
North Dakota	(2)	[2] 47,783	661,842	1,656,467	2,366,092
South Dakota	(2)	[2] 1,405		25,422	26,827
Total	(2)	[2] 104,761	661,842	1,787,557	2,554,160

[1] Total of 15 machines used—10 "permissible" and 5 other types.
[2] Small amount of "Mined by hand" included under "Shot off the solid."

NUMBER AND SIZE OF LIGNITE MINES

For 1944 the Bureau of Mines received reports from 108 lignite mines (exclusive of some mines producing less than 1,000 tons a year). Most of the operations were in North Dakota which had 84; Montana was next in order with 14 mines; and South Dakota and Texas followed, with 7 and 3, respectively. The classification by size of output in the field as a whole in 1944 is given in table 46.

TABLE 46.—*Number and production of lignite mines in the United States in 1944, classified by size of output*

Class	Mines		Production		
			Net tons		Percent of total
	Number	Percent	Total	Average per mine	
1. 200,000 tons and over	6	5.5	1,958,702	326,450	76.7
2. 100,000 and under 200,000	1	.9	104,525	104,525	4.1
3. 50,000 and under 100,000	2	1.9	161,167	80,584	6.3
4. 10,000 and under 50,000	10	9.3	193,718	19,372	7.6
5. Under 10,000 tons	89	82.4	136,048	1,529	5.3
Total	108	100.0	2,554,160	23,650	100.0

STRIPPING OPERATIONS

The production of lignite from strip pits in 1944 amounted to 1,787,557 tons—70 percent of the total output of the industry. As for many years in the past most of the stripping—that is, 93 percent of all strip-pit production and 65 percent of the total tonnage produced by the lignite industry—was done in North Dakota, where 1,656,467 tons were produced by that method. The output from stripping operations in Texas, Montana, and South Dakota was only 131,090 tons. The number of men employed in stripping operations was 596 with an average output per man per day of 17.13 tons and the average number of days worked was 199.

Detailed statistics for stripping operations in the lignite industry in 1944 are given in table 47.

TABLE 47.—*Summary of stripping operations that produced lignite in the United States in 1944, by States*

State	Number of strip pits[1]	Number of shovels, drag-line excavators, and coal-loading machines[2]	Coal produced (net tons)		Total value at mines (thousand dollars)	Average value per ton	Number of employees				Average number of days mines operated	Man-days of labor[3]	Average tons per man per day[3]
			Mined by stripping	Total at same mines			Underground	Surface		Total			
								In strip pits	All others				
Montana and Texas	4	4	105,668	105,668	88	$0.83	----	29	10	39	159	6,220	16.99
North Dakota	48	60	1,656,467	1,897,371	2,849	1.50	68	254	213	535	202	107,844	17.59
South Dakota	3	5	25,422	25,422	51	2.00	----	20	2	22	199	4,372	5.81
Total	55	69	1,787,557	2,028,461	2,988	1.47	68	303	225	596	199	118,436	17.13

[1] Includes some pits in which stripping is done by hand.
[2] In some cases same equipment was used for stripping or excavating and for loading coal; such duplication has been eliminated. In some cases coal was excavated by machine and loaded by hand.
[3] Based upon calculated man-days.

IMPORTS AND EXPORTS[4]

TABLE 48.—*Bituminous coal[1] imported for consumption in the United States, 1943–45, by countries and customs districts, in net tons*

	1943	1944	1945
COUNTRY			
North America:			
Canada	746,573	631,988	466,565
Mexico	72	--------	1
South America:			
Chile	--------	68	--------
Colombia	--------	16	--------
Peru	--------	--------	7
Europe:			
U. S. S. R.	--------	370	--------
United Kingdom	10,989	1,221	577
Oceania:			
Australia	--------	--------	318
New Zealand	--------	--------	2
Africa: Union of South Africa	--------	26	3
	757,634	633,689	467,473
CUSTOMS DISTRICT			
Alaska	33,349	19,930	--------
Buffalo	483	--------	--------
Chicago	--------	--------	2
Dakota	604	340	491
CUSTOMS DISTRICT—con.			
Duluth and Superior	123	166	327
Los Angeles	--------	68	--------
Maine and New Hampshire	106,853	108,709	105,020
Maryland	784	--------	--------
Massachusetts	5,542	--------	--------
Michigan	--------	(2)	84
Montana and Idaho	498,072	430,734	276,055
New York	4,258	1,263	731
Oregon	--------	370	--------
Philadelphia	1,383	866	--------
Pittsburgh	--------	--------	8
St. Lawrence	--------	--------	97
San Francisco	--------	--------	16
Vermont	--------	--------	786
Virginia	--------	--------	151
Washington	106,183	71,243	83,643
Wisconsin	--------	--------	62
	757,634	633,689	467,473

[1] Includes slack, culm, and lignite.
[2] Less than 1 ton.

[4] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

TABLE 49.—*Exports of bituminous coal to Canada and Mexico, West Indies and Central America, and "overseas" destinations, 1941–45, in thousands of net tons*

Year	Canada and Mexico	West Indies and Central America [1]	"Overseas" (all other countries): Newfoundland, Miquelon, Bermuda, Greenland, and Iceland	South America	Europe	Asia	Africa	Oceania	Total "overseas"	Grand total
1941	18,196	332	186	1,541	370	25	62	28	2,212	20,740
1942	21,017	440	90	925	253	4	214	--------	1,486	22,943
1943	24,272	462	111	589	294	--------	108	--------	1,102	25,836
1944	24,369	356	157	580	218	(2)	352	--------	1,307	26,032
1945	21,581	295	191	1,080	3,916	(2)	868	11	6,066	27,942

[1] Includes Bahamas and Panama.
[2] Less than 1,000 net tons.

TABLE 50.—*Bituminous coal exported from the United States, 1943–45, by countries, in net tons* [1]

Country	1943	1944	1945
North America:			
Bermuda	6,261	6,873	8,234
Canada	24,269,585	24,366,929	21,578,281
Central America:			
British Honduras	66	38	424
Costa Rica	168	2,551	26
El Salvador	------------	96	71
Guatemala	94	172	190
Honduras	103	619	400
Nicaragua	7	48	3
Panama:			
Canal Zone	47,757	53,626	25,667
Republic of	6	13	12
Greenland	2,836	1,170	940
Mexico	2,323	2,981	2,629
Newfoundland and Labrador	102,207	149,050	181,663
West Indies:			
British:			
Barbados	------------	3,572	2,006
Jamaica	19,757	45,741	38,102
Trinidad and Tobago	143,597	73,739	110,252
Other British	114	4,002	2,318
Cuba	233,728	148,559	99,706
Curaçao (N. W. I.)	172	347	971
Dominican Republic	69	1,985	971
French	16,132	20,469	13,661
Haiti	16	36	35
	24,844,998	24,882,616	22,066,562
South America:			
Argentina	128,172	196,165	313,784
Bolivia	20,409	26,571	5,240
Brazil	337,969	289,434	665,112
Chile	16,438	15,991	6,359
Falkland Islands	1,214	94	106
Surinam	2,299	4,345	2,218
Uruguay	82,819	46,944	86,879
Other South America	9	211	821
	589,329	579,755	1,080,519
Europe:			
Azores	8,359	------------	4,698
Belgium and Luxembourg	------------	------------	436,644
Denmark	------------	------------	199,244
France	------------	------------	624,378
Gibraltar	------------	------------	144,603
Greece	------------	------------	37,351
Italy	------------	------------	1,102,351
Netherlands	------------	------------	433,773
Norway	------------	------------	353,610

See footnote at end of table.

TABLE 50.—*Bituminous coal exported from the United States, 1943–45 by countries, in net tons*—Continued

Country	1943	1944	1945
Europe—Continued			
Portugal	267,600	213,370	344,746
Spain	5,594	4,507	112
Sweden			134,496
Switzerland			98,787
U. S. S. R.	11,929	300	
United Kingdom	49	49	1,245
	293,531	218,226	3,916,038
Asia		35	26
Africa:			
Algeria		279,480	561,830
British West Africa			47,220
Canary Islands	7,131	20,748	12,555
Cape Verde Islands	3,384	13,962	7,620
Egypt	77,740	1	
French West Africa			67,229
Madeira Islands	9,433	9,073	14,123
Morocco:			
French			71,601
Spanish	10,662	25,693	15,725
Tunisia		2,753	70,245
Other Africa		6	9
	108,350	351,716	868,157
Oceania			10,555
	25,836,208	26,032,348	27,941,857

[1] Amounts stated do not include fuel or bunker coal loaded on vessels engaged in foreign trade, which aggregated 1,646,561 tons in 1943, 1,559,335 tons in 1944, and 1,784,956 tons in 1945.

TABLE 51.—*Bituminous coal exported from the United States, 1943–45, by customs districts, in net tons*

Customs district	1943	1944	1945
North Atlantic:			
Maine and New Hampshire	5,620	11,009	12,087
Massachusetts	4	2	
New York	23,694	26,164	36,027
Philadelphia	279,424	307,671	1,160,647
South Atlantic:			
Maryland	101,711	168,541	2,264,127
North Carolina	1,682		
South Carolina			294,753
Virginia	900,768	1,021,447	1,643,106
Gulf Coast:			
Florida	202,358	286,731	977,504
Galveston			89,128
Mobile	84,362	57,716	347,207
New Orleans	26,964	25,910	19,650
Mexican border:			
Arizona	792	428	338
El Paso	1,116	1,612	277
Laredo	6	1	21
Pacific Coast:			
Los Angeles	37	394	
San Diego	106	82	164
San Francisco		300	14
Washington	18,642	640	1,020
Northern border:			
Buffalo	1,513,678	1,696,135	1,413,882
Chicago	1,058,754	1,582,563	583,981
Dakota	55,100	7,478	15,555
Duluth and Superior	270,131	365,798	273,868
Michigan	2,539,950	1,821,036	2,297,837
Montana and Idaho			9
Ohio	11,764,246	12,094,748	10,825,722
Rochester	4,146,174	3,318,098	3,155,747
St. Lawrence	2,834,424	3,227,283	2,523,021
Vermont	692	5,049	1,263
Wisconsin	581	125	468
Miscellaneous:			
Alaska	5,192	5,387	78
Pittsburgh			4,356
	25,836,208	26,032,348	27,941,857

TABLE 52.—*Shipments of bituminous coal to noncontiguous Territories, 1943–45*

Territory	1943		1944		1945	
	Net tons	Value	Net tons	Value	Net tons	Value
Alaska:						
Anthracite	11,269	$161,730	39,964	$491,412	36,599	$464,053
Bituminous						
Hawaii	571	15,263	429	13,965	567	17,586
Puerto Rico	13,860	78,727	11,428	73,733	8,220	50,204
Virgin Islands					32,168	218,066

WORLD PRODUCTION

World production of coal and lignite, 1938–45, by countries, in thousands of metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
North America:								
Canada:								
Coal	9,815	10,985	12,638	12,872	13,018	11,591	14,201	13,539
Lignite	3,153	3,094	3,298	3,662	4,096	4,610	1,245	1,391
Greenland	7	(2)	6	7	5	7	(3)	(3)
Mexico	893	628	816	856	914	1,025	904	(3)
United States:								
Anthracite (Pennsylvania)	41,820	46,708	46,706	51,136	54,728	55,015	57,789	49,835
Bituminous	313,473	355,445	415,336	463.908	525,948	532,903	559,750	522,536
Lignite	2,720	2,760	2,666	2,518	2,659	2,494	2,317	
South America:								
Brazil	883	1,047	1,336	1,408	1,757	2,034	1,856	(3)
Chile	2,044	1,850	1,934	2,062	2,151	2,277	[4] 2,288	(3)
Colombia	331	349	521	403	415	476	499	(3)
Peru	75	108	153	117	150	187	173	[4] 188
Venezuela	6	3	5	6	9	11	7	(3)
Europe:								
Albania: Lignite	4	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Belgium	29,585	29,843	25,599	26,608	24,929	23,743	13,505	15,718
Bulgaria:								
Coal	142	164	188	2,256	2,781	[4] 2,000	(3)	(3)
Lignite	1,855	2,134	2,700					
Czechoslovakia:								
Coal	15,800	(2)	(3)	(3)	(3)	(3)	(3)	[5] 6,019
Lignite	14,717	[6] 779	[6] 805	[6] 816	[6] 813	(3)	(3)	[5] 8,238
Denmark: Lignite	(3)	(3)	(3)	[4] 1,000	[4] 1,800	[4] 2,400	(3)	(3)
Eire	120	120	118	155	167	186	206	(3)
Faroe Islands: Lignite	8	8	(3)	(3)	(3)	(3)	(3)	(3)
France:								
Coal	46,504	49,147	39,323	41,849	41,869	40,557	26,602	35,071
Lignite	1,058	1,102	1,661	2,008	1,958	1,870	(3)	
Germany:								
Coal	186,177	[7] 199,258	251,430	[8] 254,121	262,818	(3)	(3)	(3)
Lignite	193,789	[7] 229,645	245,494	[8] 256,732	268,046	(3)	(3)	(3)
Austria:								
Coal	227	217	228	226	225	(3)	(3)	(3)
Lignite	3,342	3,533	3,614	3,537	3,523	(3)	(3)	(3)
Greece: Lignite	108	139	(3)	[4] 180	[4] 350	[4] 125	(3)	(3)
Hungary:								
Coal	1,042	1,107	11,513	12,632	12,964	12,506	[4] 9,000	[4] 4,000
Lignite	8,317	9,518						
Italy:								
Coal	1,480	2,024	2,282	2,393	2,522	(3)	(3)	(3)
Lignite	873	1,099	2,109	2,030	2,306	(3)	(3)	709
Netherlands:								
Coal	13,488	12,861	12,149	[9] 12,855	[9] 12,520	12,497	(3)	(3)
Lignite	171	197	(3)	(3)	(3)	(3)	(3)	(3)
Poland:								
Coal	38,104	(2)	(3)	(3)	(3)	(3)	(3)	21,004
Lignite	10	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Portugal:								
Coal	299	299	369	435	438	403	426	436
Lignite	15	35	64	84	108	106	127	146

See footnotes at end of table.

World production of coal and lignite, 1938–45, by countries, in thousands of metric tons—Continued

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Europe—Continued								
Rumania:								
Coal	299	285	251	230	194	202	202	(3)
Lignite	2,097	2,300	2,385	2,167	2,422	2,669	2,069	(3)
Spain:								
Coal	5,649	6,606	8,862	8,763	9,257	9,591	10,485	10,632
Lignite	166	194	569	793	1,106	1,112	1,202	1,322
Svalbard (Spitsbergen)	627	640	(3)	(3)	(3)	(3)	(3)	(3)
Sweden	431	444	498	557	582	(3)	(3)	[4] 500
Switzerland:								
Coal	3	3	8	72	184	157	71	} 311
Lignite	------	------	------	8	27	75	74	
U. S. S. R.:								
Coal	} 98,627	134,500	148,700	146,800	[4] 90,000	[4] 131,400	[4] 118,000	[4] 145,000
Lignite		(2)	15,900	(3)	(3)	(3)	(3)	(3)
United Kingdom:								
Great Britain	230,659	235,051	227,898	209,656	206,901	197,615	188,446	174,683
Northern Ireland:								
Coal	(10)	(10)	(10)	(10)	3	(10)	(10)	(3)
Lignite	------	------	(10)	(10)	1	1	2	(3)
Yugoslavia:								
Coal	450	444	} [11] 3,170	7,310	[11] [12] 1,160	(3)	(3)	(3)
Lignite	5,287	5,622						
Asia:								
British Borneo	(10)	(10)	(3)	(3)	(3)	(3)	(3)	(3)
China (Free)	4,260	4,568	5,716	6,000	5,652	5,995	5,458	(3)
Manchuria	15,000	19,000	21,630	24,500	25,500	(3)	(3)	(3)
Federated Malay States	486	448	794	(3)	(3)	(3)	(3)	(3)
India	28,798	28,214	29,860	29,937	29,906	25,921	(3)	(3)
Indochina:								
Coal	2,340	2,588	2,470	[12] 1,117	[12] 732	1,293	(3)	(3)
Lignite	4	27	30	(3)	(3)	(3)	(3)	(3)
Japan:								
Formosa (Taiwan)	(2)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Japan proper:								
Coal	(2)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Lignite	(2)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Karafuto	(2)	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Korea (Chosen)	3,200	4,481	(3)	(3)	(3)	(3)	(3)	(3)
Netherlands Indies	1,457	1,781	2,009	[13] 778	(3)	(3)	(3)	(3)
Philippine Islands	41	47	(3)	(3)	(3)	(3)	(3)	(3)
Syria and Lebanon: Lignite	(10)	1	2	8	7	1	2	2
Turkey:								
Coal	2,589	2,696	3,019	3,020	2,510	3,166	3,560	3,716
Lignite	129	151	219	264	409	589	763	648
U. S. S. R.:								
Coal	} 34,261	(2)	(3)	(3)	(3)	(3)	(3)	(3)
Lignite								
Africa:								
Algeria:								
Coal	13	(2)	50	80	148	117	120	(3)
Lignite	------	------	------	3	7	1	1	(3)
Belgian Congo: Coal	42	27	23	30	43	69	49	45
Madagascar	(3)	(3)	(3)	1	2	6	2	(3)
Morocco, French	123	116	143	140	118	102	134	[12] 89
Nigeria	368	311	313	(3)	(3)	(3)	(3)	(3)
Portuguese East Africa	10	8	20	17	7	13	16	(3)
Southern Rhodesia	1,044	1,118	[14] 1,257	[14] 1,399	[14] 1,487	[14] 1,713	1,808	1,669
Tunisia: Lignite	------	2	28	102	142	41	(3)	(3)
Union of South Africa	16,284	16,890	17,176	18,337	20,408	20,561	22,987	[15] 17,495
Oceania:								
Australia:								
New South Wales	9,725	11,376	9,703	11,955	12,433	11,714	11,280	10,339
Queensland	1,131	1,339	1,306	1,477	1,663	1,727	1,686	(3)
Tasmania	85	99	84	111	137	148	146	(3)
Victoria:								
Coal	312	371	272	332	318	292	262	(3)
Lignite	3,734	3,710	4,347	4,639	5,013	5,173	5,097	(3)
Western Australia	614	566	548	566	591	540	567	(3)
New Zealand:								
Coal	994	1,061	1,163	1,199	1,194	1,157	1,085	} 2,870
Lignite	1,264	1,319	1,393	1,483	1,529	1,676	1,766	
Total, all grades	1,460,000	1,597,000	(3)	(3)	(3)	(3)	(3)	(3)

See footnotes at end of table.

World production of coal and lignite, 1938–45, by countries, in thousands of metric tons [1]—Continued

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Lignite (total of items shown above)	263,000	302,000	(3)	(3)	(3)	(3)	(3)	(3)
Bituminous and anthracite (by subtraction)	1,197,000	1,295,000	(3)	(3)	(3)	(3)	(3)	(3)

1 Coal is also mined in Argentina, Iran, and Italian East Africa, but production figures of those countries not available.
2 Estimate included in total.
3 Data not yet available.
4 Estimate.
5 May to December, inclusive.
6 Estimated production of Slovakia only.
7 Beginning in 1939, includes Sudetenland, Bohemia, and Moravia.
8 Beginning in 1941, also includes German-occupied Poland.
9 Fiscal year ended March 31, of year following that stated.
10 Production of less than 1,000 tons.
11 Estimated production of Croatia only.
12 January to June, inclusive.
13 Production of Government mines only.
14 Tonnage raised by Wankie colliery for year ended August 31 of year stated.
15 January to September, inclusive.

PENNSYLVANIA ANTHRACITE

By J. A. Corgan and Marian I. Cooke

SUMMARY OUTLINE

REVIEW OF 1945

The heavy demand for Pennsylvania anthracite during the war period continued throughout 1945, and the output of 54,933,909 net tons was not sufficient to meet the increased requirements created by shortages of other spaceheating fuels, the requests from Canada for large tonnages, and the expanded purchasing power of domestic consumers. The sharp decline in production—14 percent less than the output of 63,701,363 tons in 1944—is directly attributable to the scarcity of manpower, difficulty in obtaining equipment and supplies, and labor disturbances which shut down the mines completely for 3 weeks. Of the total production loss (8,767,454 tons), deep mines accounted for 79 percent, strip pits and culm banks 19 percent, and river coal 2 percent. In accordance with an arrangement made by the operators and the United Mine Workers of America in January 1943, the miners worked 6 days a week in 1945. The total days operated by the industry—269—was the highest since 1924, with the exception of the 270 and 292 days worked in 1943 and 1944, respectively.

The anthracite distribution program, inaugurated in 1943 by the Solid Fuels Administration for War, was continued through October 1945, when virtually all regulatory measures were rescinded. The Bureau of Mines worked closely with the Solid Fuels Administration for War in compiling detailed statistical data relating to production, distribution, consumption, utilization, and market requirements of anthracite, and that agency based its entire wartime program for the equitable distribution of hard coal upon those data.

From May 3 to June 23, 1945, all anthracite mines were operated under the control of the Federal Government because of unsettled labor conditions occasioned by the absence of a contract between the producers and the United Mine Workers of America to supersede the one that expired on April 30. The mines were closed entirely from May 1 to May 19, and the Bureau of Mines estimates that this stoppage of work resulted in a production loss of 3,500,000 net tons of anthracite. This loss in output added considerably to the scarcity of fuels in the New England and Middle Atlantic States.

The output of anthracite from "bootleg" holes totaled 1,026,000 net tons in 1945, a sharp decline from the record output of 6,300,000 tons reached in 1941. The decrease may be attributed largely to the efforts of the Anthracite Committee to eliminate this kind of mining, the induction of young men into the armed forces, and increased opportunities for employment in other industries.

Anthracite Industries, Inc. (now Anthracite Institute), expanded its research and promotional activities considerably, announcing improvements in the Anthratube, a new heating device for burning anthracite (see details under Anthracite Institute and Research).

Research by the Bureau of Mines on new and improved methods of mining anthracite mechanically and on the control of mine water and flood prevention was continued in 1945. It is expected that a research laboratory will be erected in the anthracite region in the near future; investigations and research to be conducted through facilities thus afforded will relate particularly to the mining, preparation, and utilization of anthracite and to safety, health, and sanitation in mining operations. The research program at the Pennsylvania State College on new and improved uses for anthracite, sponsored by the Anthracite Institute and the Commonwealth of Pennsylvania, was continued on the gasification of anthracite, the preparation of activated carbon, and the utilization of anthracite silt. Studies are also being conducted on the flow of gases through fuel beds and wall effects.

Definition of Pennsylvania anthracite.—Pennsylvania anthracite includes all nonbituminous coal mined in that State; for historical purposes data on the output of the Bernice Basin in Sullivan County are included in this chapter, although the coal of this basin has been officially classified as semianthracite. The anthracite fields are in the northeastern part of the State, and the coal is mined in the following counties: Carbon, Columbia, Dauphin, Lebanon, Lackawanna, Luzerne, Northumberland, Schuylkill, Susquehanna, and Wayne.

Statistical trends.—Tables 1 and 2 present pertinent statistical data on the Pennsylvania anthracite industry.

Anthracite Institute.—In the interest of greater efficiency and an expanded research program for the industry, the activities of Anthracite Institute and The Anthracite Industries, Inc., were consolidated under one industry organization, Anthracite Institute, at a meeting of the boards of directors of both groups on January 8, 1946. In the past, Anthracite Institute functioned mainly on problems pertaining to production, statistics, and general industry matters, while The Anthracite Industries, Inc., was responsible for research, dealer and equipment trade contracts, advertising, and public relations.

TABLE 1.—*Statistical trends of Pennsylvania anthracite industry, 1941–45*

	1941	1942	1943	1944	1945
Production:					
Loaded at mines for shipment:					
Breakers net tons	46,864,422	51,173,756	[1] 50,812,873	53,067,227	45,249,706
Washeries do	2,538,692	1,957,926	[1] 2,401,065	3,492,187	2,551,426
Dredges do	1,008,983	778,019	821,899	1,081,156	741,319
Sold to local trade and used by employees net tons	3,695,125	4,059,403	4,233,732	3,765,641	4,273,864
Used at collieries for power and heat net tons	2,261,045	2,358,625	2,374,051	2,295,152	2,117,594
Total production do	56,368,267	60,327,729	60,643,620	63,701,363	54,933,909
Value at breaker, washery, or dredge	$240,275,000	$271,673,000	$306,816,018	$354,582,884	$323,944,435
Average sales realization per net ton on breaker shipments:					
Domestic:					
Lump and Broken	$5.72	$6.03	$6.77	$7.47	$8.02
Egg	$5.84	$6.24	$6.96	$7.56	$8.13
Stove	$5.93	$6.26	$6.96	$7.57	$8.10
Chestnut	$5.93	$6.28	$6.97	$7.58	$8.12
Pea	$4.50	$4.85	$5.48	$6.11	$6.62
Total domestic	$5.68	$6.05	$6.76	$7.38	$7.93
Steam:					
Buckwheat No. 1	$3.37	$3.46	$4.00	$4.52	$4.79
Buckwheat No. 2 (Rice)	$2.52	$2.63	$3.12	$3.59	$3.91
Buckwheat No. 3 (Barley)	$1.78	$1.89	$2.25	$2.53	$2.65
Buckwheat No. 4	$1.07	$1.17	$1.55	$1.82	$1.85
Other (including silt)	$ .87	$ .83	$1.13	$1.39	$1.58
Total steam	$2.55	$2.58	$3.02	$3.42	$3.56
Total all sizes	$4.59	$4.79	$5.38	$5.91	$6.26
Percent by sizes in total breaker shipments:					
Domestic:					
Lump and Broken	0.3	0.3	0.4	0.3	0.3
Egg	4.2	5.2	7.1	7.1	6.5
Stove	24.3	23.6	22.4	21.9	21.7
Chestnut	25.5	24.9	24.5	25.2	25.5
Pea	10.8	9.6	8.7	8.3	7.8
Total domestic	65.1	63.6	63.1	62.8	61.8
Steam:					
Buckwheat No. 1	14.6	14.5	14.2	14.2	14.1
Buckwheat No. 2 (Rice)	8.2	8.0	8.3	8.5	8.1
Buckwheat No. 3 (Barley)	8.9	9.6	9.9	9.7	9.9
Buckwheat No. 4	2.4	3.3	3.0	3.1	3.6
Other (including silt)	0.8	1.0	1.5	1.7	2.5
Total steam	34.9	36.4	36.9	37.2	38.2
Producers' stocks [2] net tons	1,274,000	798,000	329,000	445,000	130,000
Exports [3] do	3,380,000	4,439,000	4,139,000	4,186,000	3,691,000
Imports [3] do	75,000	140,000	166,000	12,000	149
Consumption (calculated) do	52,700,000	56,500,000	57,100,000	59,400,000	51,600,000
Average number of days worked	203	239	270	292	269
Man-days lost on account of strikes and lock-outs	397,616	279,641	(4)	(4)	(4)
Number of men on strike during year	39,768	26,631	(4)	(4)	(4)
Average number of men employed	88,054	82,121	79,153	77,591	72,842
Output per man per day net tons	3.04	2.95	2.78	2.79	2.79
Output per man per year do	617	705	751	815	751
Quantity cut by machines do	1,855,422	2,285,640	1,624,883	1,336,082	1,210,171
Quantity mined by stripping do	7,316,574	9,070,933	8,989,387	10,953,030	10,056,325
Quantity loaded by machines underground net tons	13,441,987	14,741,459	14,745,793	14,975,146	13,927,955
Distribution:					
Total receipts in New England [5] net tons	5,551,000	5,974,000	5,722,000	6,222,000	5,081,000
Exports to Canada [3] do	3,361,000	4,418,000	4,097,000	4,144,000	3,393,000
Loaded into vessels at Lake Erie [6] net tons	536,000	575,000	661,000	1,066,000	1,234,000
Receipts at Duluth-Superior [7] do	253,000	222,000	302,000	580,000	766,000

[1] Small quantity of washery coal included under "Breakers."
[2] Anthracite Committee.
[3] U. S. Department of Commerce.
[4] Data not available.
[5] Commonwealth of Massachusetts, Division on the Necessaries of Life, and Association of American Railroads.
[6] Ore and Coal Exchange, Cleveland, Ohio.
[7] U. S. Engineer Office, Duluth, Minn.

TABLE 2.—*Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1945*

[All tonnage figures represent net tons]

	January 1945	February 1945	March 1945	April 1945	May 1945	June 1945	July 1945	August 1945	September 1945	October 1945	November 1945	December 1945	Year 1945: Total	Year 1945: Change from 1944 (percent)	1944 (total)
Production, including mine fuel, local sales, and dredge coal:															
Monthly total	4,219,000	4,471,000	5,269,000	5,124,000	2,083,000	5,667,000	4,944,000	4,656,000	4,640,000	5,304,000	4,559,000	3,998,000	54,934,000	−13.8	63,701,000
Shipments, breakers and washeries only, monthly total, all sizes:															
By rail [1]	3,350,803	3,637,392	4,273,143	4,129,144	1,617,604	4,614,465	4,063,464	3,904,545	3,962,979	4,389,751	3,752,349	3,391,078	45,086,717	−15.3	53,215,046
By truck [2]	799,898	803,065	606,448	707,774	305,759	676,993	582,822	608,668	565,641	628,881	543,806	766,354	7,596,109	−1.5	7,712,978
Distribution:															
Lake Erie loadings [3]				158,002	88,271	253,771	142,555	151,223	124,737	157,226	144,081	13,720	1,233,586	+15.7	1,066,389
Lake Ontario loadings [4]				30,057	10,969	52,212	54,768	54,120	55,757	42,875	41,016		341,774	−2.3	349,738
Receipts at Duluth-Superior [5]				112,989	48,811	128,267	120,626	95,469	70,101	115,336	73,944		765,543	+32.0	579,828
Upper Lake dock trade: [6]															
Receipts:															
Lake Superior		214		111,986	50,489	134,024	122,284	102,457	80,311	121,029	81,715		804,509	+52.8	526,374
Lake Michigan	2,720	2,483	5,398	52,258	15,260	79,601	52,134	52,867	44,355	54,908	46,476	9,200	417,660	+14.9	363,572
Deliveries (reloadings):															
Lake Superior	63,326	47,567	27,793	29,594	48,262	50,157	52,437	68,527	79,217	88,795	75,495	69,850	701,020	+54.1	454,994
Lake Michigan	31,414	22,822	28,291	27,287	32,275	34,503	31,838	33,714	30,677	48,988	37,323	39,286	398,418	+16.8	341,230
New England receipts:															
By tidewater [7]	24,193	21,435	15,773	30,398	10,519	35,794	36,296	29,091	36,863	36,913	27,754	26,248	331,277	−14.2	386,042
By rail [8]	339,595	375,874	467,912	464,821	186,271	450,633	461,463	389,816	392,151	470,693	364,330	386,062	4,749,621	−18.6	5,836,330
Exports [9]	212,866	254,409	329,160	337,751	126,782	322,009	333,766	310,734	335,904	364,903	403,751	359,212	3,691,247	−11.8	4,185,933
Imports [9]							134		15				149	−98.7	11,847
Industrial consumption and stocks by:															
Railroads (class 1 only): [7]															
Consumption	109,213	100,548	98,270	87,810	71,765	68,160	68,045	66,216	67,020	80,817	87,510	103,664	1,009,038	−7.7	1,093,651
Stocks	174,777	172,073	171,088	174,491	148,182	155,571	162,541	174,634	174,740	131,618	125,715	113,745	113,745	−41.5	194,534
Electric-power utilities: [10]															
Consumption	298,841	278,007	277,307	255,008	245,569	252,698	262,999	253,903	242,503	249,415	237,656	267,627	3,121,653	−8.9	3,427,479
Stocks	1,531,102	1,488,800	1,483,703	1,464,295	1,403,795	1,445,162	1,467,832	1,480,709	1,522,540	1,538,804	1,558,479	1,583,515	1,583,515	−4.3	1,654,132
Other industrial consumers (selected representative plants):															
Stocks, end of month	1,164,698	1,134,365	1,115,452	775,794	715,021	1,079,710	648,890	1,100,766	797,863	673,297	536,925	672,683	672,683	−22.3	866,169
Consumed during month	401,939	388,230	371,556	264,434	264,366	270,701	173,545	235,508	192,051	201,085	194,468	267,309	(11)		(11)
Supply, end of month (days)	90	82	93	86	84	120	115	145	125	104	83	78	78	−6.0	83
Number of firms reporting	754	794	779	757	760	708	649	654	672	614	613	633	633		765
Retail dealers (selected representative plants):															
Stocks, end of month	471,777	461,325	539,225	664,440	486,084	683,039	618,673	599,109	652,104	559,734	554,967	478,095	478,095	−42.0	824,199
Deliveries during month	1,275,774	1,245,508	1,294,969	1,208,781	795,219	1,171,436	1,118,810	1,157,346	1,132,828	1,068,557	860,214	1,123,940	(11)		(11)
Supply, end of month (days)	11	10	13	16	19	17	17	16	17	16	19	13	13	−31.6	19
Number of dealers reporting	3,431	3,708	3,554	3,523	3,625	3,560	3,427	3,447	3,426	3,112	3,066	3,143	3,143		3,567

See footnotes at end of table.

TABLE 2—*Statistical summary of monthly developments in the Pennsylvania anthracite industry in 1945*—Continued.

[All tonnage figures represent net tons]

	January 1945	February 1945	March 1945	April 1945	May 1945	June 1945	July 1945	August 1945	September 1945	October 1945	November 1945	December 1945	Year 1945: Total	Year 1945: Change from 1944 (percent)	1944 (total)
Industrial consumption and stocks—Continued.															
Retail dealers (selected representative plants)—Con.															
Stocks on Upper Lake docks: [6]															
Lake Superior	84,826	43,972	15,123	97,605	99,832	183,686	253,533	287,462	288,556	320,790	327,009	257,158	257,158	+104.9	125,500
Lake Michigan	79,737	59,398	36,429	61,400	44,385	89,483	109,779	128,932	142,610	148,530	157,683	127,597	127,597	+17.7	108,431
Producers' stocks [12]	322,217	289,361	285,254	277,427	218,721	179,764	174,033	198,266	203,481	140,209	131,608	130,135	130,135	−70.7	444,508
Sales of mechanical stokers: [9]															
Class 1 (capacity under 61 lb. of coal per hour)	154	208	144	254	165	231	177	316	334	587	389	366	3,325	+638.9	450
Class 2 (capacity 61 to 100 lb. of coal per hour)	135	137	122	74	175	168	260	207	171	168	148	118	1,883	−16.0	2,243
Prices at mines, average per net ton: [13]															
Group 1:															
Company Stove	$7.85	$7.85	$7.85	$7.85	$7.85	$8.25	$8.85	$8.85	$8.85	$8.85	$8.85	$9.00	$8.40	+5.5	$7.96
Company Buckwheat No. 1	$4.65	$4.65	$4.65	$4.65	$4.65	$4.85	$5.15	$5.15	$5.15	$5.15	$5.15	$5.25	$4.93	+3.6	$4.76
Group 2:															
Company Stove	$7.85	$7.85	$7.85	$7.85	$7.85	$8.25	$8.85	$8.85	$8.85	$8.85	$8.85	$9.50	$8.44	+6.0	$7.96
Company Buckwheat No. 1	$4.65	$4.65	$4.65	$4.65	$4.65	$4.85	$5.15	$5.15	$5.15	$5.15	$5.15	$5.70	$4.96	+4.2	$4.76
Wholesale prices: [14]															
On tracks, destination:															
Chestnut	$11.43	$11.43	$11.43	$11.43	$11.48	$11.76	$12.21	$12.23	$12.28	$12.28	$12.28	$12.39	$11.89	+3.7	$11.47
Pea	$10.04	$10.04	$10.04	$10.05	$10.05	$10.27	$10.66	$10.68	$10.74	$10.74	$10.74	$10.92	$10.41	+3.4	$10.07
Index numbers (1926=100)	95.3	95.3	95.3	95.3	95.6	97.5	101.6	101.8	102.2	102.2	102.2	103.4	99.0	+3.6	95.6
Labor conditions: [14]															
Average weekly earnings	$44.81	$48.68	$48.76	$44.92	$38.10	$47.48	$47.47	$49.29	$49.85	$56.45	$47.75	$54.62	$48.98	+2.2	$47.93
Average hourly earnings	$1.154	$1.164	$1.179	$1.153	$1.039	$1.170	$1.219	$1.327	$1.345	$1.368	$1.333	$1.380	$1.252	+6.3	$1.178
Average hours worked per week	38.9	41.7	41.4	38.9	36.4	41.1	39.4	37.1	37.0	41.2	35.8	39.6	39.2	−3.7	40.7
Index of employment (1939 average=100)	79.0	79.2	79.0	77.4	9.7	78.9	77.6	77.4	77.6	78.1	78.2	79.0	72.6	−10.8	81.4
Index of payroll totals (1939 average=100)	137.7	150.2	149.7	135.1	14.3	145.4	142.7	148.0	149.8	170.8	144.5	167.1	137.9	−8.9	151.4

[1] Furnished by Anthracite Institute. [2] Pennsylvania Department of Mines. [3] Ore and Coal Exchange, Cleveland, Ohio.
[4] Buffalo Branch, Ore and Coal Exchange, Cleveland, Ohio. [5] U. S. Engineer Office, Duluth, Minn.
[6] Includes all commercial docks on Lake Superior and west shore of Lake Michigan as far south as Kenosha. Based on data courteously supplied by Maher Coal Bureau and direct reports to the Bureau of Mines.
[7] Association of American Railroads. [8] Furnished by Commonwealth of Massachusetts, Division on the Necessaries of Life.
[9] U. S. Department of Commerce. [10] Federal Power Commission. [11] Data not available.
[12] Anthracite Committee. Represents coal in storage closest available date to the end of the month.
[13] Computed from weekly quotations from trade journals. Figures represent circular prices quoted on white ash by leading anthracite-producing companies.
[14] Bureau of Labor Statistics.

To facilitate the administration of its increased activities, Anthracite Institute has established offices in Wilkes-Barre, Pa., to take care of all matters pertaining to production, statistics, and other general industry affairs. The research laboratory now located at Primos, Pa., will be moved to the Wilkes-Barre area. Public relations, advertising, and marketing programs will continue under the direction of the present New York office.

Anthracite Committee.—The Anthracite Committee represented producers, whose combined output comprised a large part of the total output of the industry, before the Office of Price Administration, Solid Fuels Administration for War, and other Government agencies on matters concerning the welfare of the anthracite industry. The committee kept the industry well informed on "bootleg" mining operations and was particularly active in matters requiring statistics on current production, employment, and other pertinent phases of the anthracite industry.

Standard anthracite size specifications approved and adopted by the Anthracite Committee, effective January 14, 1946, are shown in table 3.

TABLE 3.—*Standard anthracite size specifications approved and adopted by Anthracite Committee, effective Jan. 14, 1946*

	Round test mesh, inches	Percent				
		Oversize maximum	Undersize		Maximum impurities	
			Maximum	Minimum	Slate[1]	Bone[1]
Broken	Through 4⅜				1½	2
	Over 3¼		15	7½		
Egg	Through 3¼ to 3	5			1½	2
	Over 2 7/16		15	7½		
Stove	Through 2 7/16	7½			2	3
	Over 1⅝		12½	7½		
Chestnut	Through 1⅝	7½			3	4
	Over 1 3/16		12½	7½		
Pea	Through 1 3/16	10			4	5
					or	
	Over 9/16		15	7½	[2] Ash, 12	
Buckwheat No. 1	Through 9/16	10			[2] Ash, 12	
	Over 5/16		15	7½		
Buckwheat No. 2 (Rice)	Through 5/16	10			[2] Ash, 13	
	Over 3/16		15	7½		
Buckwheat No. 3 (Barley)	Through 3/16	10			[2] Ash, 15	
	Over 3/32		20	10		
Buckwheat No. 4	Through 3/32	20			[2] Ash, 15	
	Over 3/64		30	10		
Buckwheat No. 5	Through 3/64	30	No Limit		[2] Ash, 16	

[1] When slate content on Broken to Chestnut, inclusive, is less than above standards, bone content may be increased by one and one-half times the decrease in the slate content under the allowable limit, but slate content specified above shall not be exceeded in any event.
[2] Ash determinations are on a dry basis.

Labor.—Early in April 1945 the anthracite producers and the United Mine Workers of America convened to discuss a new wage agreement to supersede the one that was to expire on April 30. An agreement was not reached on the expiration date, and in the absence of a contract the miners failed to report for work on May 1. Acting under the authority of the President, the Secretary of the Interior issued an order on May 3 by which the Government took possession

717372—47——59

of mines, breakers, and other producing facilities of companies producing Pennsylvania anthracite. In his order the Secretary stressed the existing critical fuel situation and explained that the daily loss in production was only adding to the present serious shortage of anthracite, which is a principal fuel for heating the homes of war workers in the East.

Despite the Government seizure, the miners did not return to work until May 21, a new contract having been signed on May 19. The estimated production loss due to the strike totaled 3,500,000 net tons. On June 23 the Secretary of the Interior terminated Government possession of the mines and returned the properties of 354 Pennsylvania anthracite-mining companies to their private owners.

Under the new agreement, the miners received an average daily wage increase of $1.375. Wages paid for travel time accounted for $1.132 per day of the total increase; an increase in the vacation pay, overtime, and shift differentials accounted for the remaining $0.243 per day. The agreement may be renegotiated at the end of 1 year. If a significant change occurs within the year in the Government wage policy, either party shall have the right to request negotiations on general wage rates.

In accordance with an agreement between the operators and the miners made early in 1943, the mine workers continued to work 6 days a week during 1945.

Research.—The Bureau of Mines continued investigative work in the anthracite fields, started in 1944, on increasing the underground output per man per day through new and improved methods of mechanical mining. In 1945, of the total underground production, 40 percent was loaded mechanically. The coal beds in the Wyoming region are relatively flat and more adaptable to present mechanical mining methods than the pitching seams in the Lehigh and Schuylkill regions; accordingly, 52 percent of the underground output of the Wyoming region was mechanically loaded in 1945 while only 22 percent of the combined output of the last two regions was so loaded. The Bureau has done considerable research on various kinds of mechanical mining machinery that are not being utilized at present in the anthracite fields. Concurrently with the mechanical mining program, the control of mine water and flood prevention are under investigation. For many years a number of companies have carried on this work independently; however, for it to be generally successful the Federal Government, the Commonwealth of Pennsylvania, and the producers must work together, since the costs of the projects, the benefits derived, and the conservation of coal reserves concern all.

Anthracite Industries, Inc. (now Anthracite Institute), continued its enlarged scope of research activities, announcing improvements in the Anthratube, a device for utilizing an entirely new method of burning anthracite. The Anthratube principle of combustion is to burn anthracite under forced draft at a high rate of combustion in a steel tube surrounded by a water jacket from which hot water circulates to the radiators in the building to be heated. The Anthratube was released by Anthracite Institute early in 1946 to heating-equipment manufacturers for production. Details of this device are discussed on page 914 of the Pennsylvania Anthracite chapter in Minerals Yearbook, 1944.

For the past 6 years the Anthracite Institute has sponsored research on new and improved uses for anthracite at the Pennsylvania State College under an agreement whereby the institute provides a portion of the funds and the Commonwealth of Pennsylvania the remainder. The program, selected by an appointed committee, currently includes the gasification of anthracite by the use of both Broken and Egg sizes in the heavy-oil and gas-oil processes; the use of Rice and Barley in the new Wellman-Galusha agitator producer; and the production of synthesis gas from anthracite by direct gasification with oxygen and steam. A report on the preparation of activated carbon, based upon studies previously completed, was released recently for publication. This study showed that a number of anthracites could be treated to give reasonably good active carbons which may have industrial application for such uses as water and gas purification. Studies on the utilization of anthracite silt have been conducted along several lines, including the following: A critical examination of several recent developments in fine coal cleaning, such as the Humphrey's spiral concentrator, the Elmore vacuum-flotation process, and the Johnson electrostatic process; dewatering and drainage studies on various fine sizes; the use of pulverized anthracite-bituminous mixtures in firing cement kilns; the use of anthracite fines in byproduct-coke manufacture and the production of Anthra-coke; and studies on the surface and inherent properties of anthracite as related to the agglomeration of anthrafines by carbonization with various binders.

Competitive fuels in the United States and principal markets.—The principal anthracite markets are the New England States, New York, New Jersey, Pennsylvania, Maryland, Delaware, and the District of Columbia. Data on the consumption of all fuels in these markets for 1945 are not available; however, the apparent total consumption of anthracite, coke, briquets, and heating and range oils, in terms of anthracite, increased 2 percent in 1944 compared with 1943. Virtually all of the increased consumption is attributable to the gain in shipments of anthracite, which supplied 62 percent of the total equivalent fuels consumed in these States. In addition to the legitimate anthracite shipped, large quantities of "bootleg" coal are moved by truck to this area. Details on the consumption of competitive fuels are shown in table 4.

In general, the supplies of fuels commonly used for space heating in the United States increased in 1944 over 1943, a substantial gain being recorded in the consumption of anthracite, while sales of heating oils declined slightly. Details on supplies of various fuels are given in table 5.

TABLE 4.—*Apparent consumption of anthracite and selected competitive fuels in the principal anthracite markets, 1942–45*

[Thousands of net tons]

Fuel	New England	New York	New Jersey	Delaware	Maryland	Pennsylvania	District of Columbia	Total	Percent of total fuels
Anthracite:									
All users: [1]									
1942	5,844	[2] 17,988	[2] 10,395	373	835	15,813	298	51,546	59.2
1943	5,604	[2] 18,555	[2] 9,527	362	873	16,540	320	51,781	61.7
1944	6,004	[2] 17,489	[2] 10,254	380	1,016	17,744	325	53,212	62.3
1945	4,867	[2] 14,488	[2] 8,666	343	868	15,776	270	45,278	(3)
Imports: [4]									
1942	140	1	------	------	------	------	------	141	.2
1943	164	2	------	------	------	------	------	166	2
1944	12	------	------	------	------	------	------	12	(5)
1945	------	------	------	------	------	------	------	(6)	(3)
Briquets:									
Domestic use:									
1942	54	26	1	(6)	4	22	(6)	107	.1
1943	53	31	2	(6)	4	27	1	118	.1
1944	76	48	12	3	7	45	1	192	.2
1945	83	67	16	3	10	52	2	233	(3)
Imports: [4]									
1942	------	------	------	------	------	------	------	------	------
1943	------	------	------	------	------	------	------	(6)	(5)
1944	------	------	------	------	------	------	------	(6)	(5)
1945	------	------	------	------	------	------	------	(6)	(3)
Coke:									
Domestic use:									
1942	1,252	1,064	408	2	13	428	2	3,169	3.6
1943	1,265	969	329	3	1	321	(6)	2,888	3.4
1944	1,352	1,232	464	7	4	386	1	3,446	4.1
1945	1,371	1,375	552	5	2	334	2	3,641	(3)
Imports: [4]									
1942	------	56	------	------	------	------	------	56	.1
1943	1	52	------	------	------	------	------	53	.1
1944	(6)	23	------	------	------	------	------	23	(5)
1945	1	19	------	------	------	------	------	20	(3)
Oil: Heating and range: [7]									
1942	11,875	10,659	4,890	158	1,061	2,817	651	32,111	36.8
1943	10,367	9,795	4,490	144	970	2,620	552	28,938	34.5
1944	10,411	9,554	4,442	140	988	2,496	526	28,557	33.4
1945	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total fuel: [8]									
1942	19,165	29,794	15,694	533	1,913	19,080	951	87,130	100.0
1943	17,454	29,404	14,348	509	1,848	19,508	873	83,944	100.0
1944	17,855	28,346	15,172	530	2,015	20,671	853	85,442	100.0
1945	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)

[1] Pennsylvania Department of Mines; illicit coal not included.
[2] An important but undetermined part of anthracite shown as shipped to New Jersey is reshipped to New York City.
[3] Data not yet available.
[4] U. S. Department of Commerce.
[5] Less than 0.05 percent.
[6] Less than 1,000 tons.
[7] Converted to coal equivalent upon basis of 4 barrels of fuel oil equaling 1 ton of coal.
[8] Excludes bituminous coal.

TABLE 5.—*Total supplies of fuels commonly used for space-heating purposes in the United States, 1937 and 1942–45*

[Wherever available, figures represent quantity actually consumed for domestic heating or for space heating offices, apartments, hotels, schools, hospitals, etc. Where such figures are not available but where the fuel is known to be used chiefly for domestic or space-heating purposes, total production (or imports) is shown to indicate trend of growth]

	1937	1942	1943	1944	1945
SOLID FUELS (NET TONS)					
Anthracite:					
Production:					
Shipments of domestic sizes	29,092,974	32,924,518	32,563,787	34,343,434	28,610,174
Shipments of Buckwheat No. 1	6,859,707	7,789,168	7,537,642	8,083,664	6,681,171
Shipments of smaller steam sizes [1]	10,250,463	13,196,015	13,934,408	15,213,472	13,251,106
Local sales	2,981,391	4,059,403	4,233,732	3,765,641	4,273,864
Total commercial production	49,184,535	57,969,104	58,269,569	61,406,211	52,816,315
Exports [2]	1,914,173	4,438,588	4,138,680	4,185,933	3,691,247
Imports for consumption [2]	395,737	140,115	166,020	11,847	149
Fuel briquets [3]	977,254	[3] 1,644,713	[3] 1,989,223	2,301,827	2,588,819
Packaged-fuel production	146,037	253,048	215,605	175,770	208,143
Coke:					
Byproduct sales for domestic use	7,807,792	5,963,474	4,784,090	6,443,329	6,574,526
Beehive sales for domestic use	299,726	98,220	101,438	274,214	200,982
Imports for consumption [2]	286,364	108,782	98,127	63,004	51,964
Gas-house-coke sales	[4] 350,700	533,882	518,825	423,675	431,361
Petroleum-coke production	1,306,600	1,338,400	1,388,400	1,803,400	2,023,000
Anthracite and semianthracite production outside of Pennsylvania	468,852	(5)	(5)	(5)	(5)
Lignite production [6]	3,218,419	2,930,661	2,749,393	2,554,160	(7)
Bituminous-coal sales for domestic use	(8)	(8)	(8)	(8)	(8)
OIL (BARRELS OF 42 GALLONS)					
Oil sales for heating buildings:					
Range oil	32,259,000	44,923,000	44,097,000	47,636,000	[9] 52,000,000
Heating oils: [10]					
Domestic / Commercial	116,617,000	168,989,000	155,251,000	152,203,000	[9] 168,500,000
Liquefied petroleum gases, domestic	972,000	7,133,000	8,080,000	10,442,000	[9] 12,875,000
GAS (MILLION CUBIC FEET)					
Natural-gas consumption for domestic and commercial use [11]	489,234	682,140	684,007	[9] 806,000	(7)
Manufactured-gas sales for: [12]					
Domestic use	193,325	205,778	208,397	215,157	(7)
House heating	45,200	79,600	83,686	84,766	(7)

[1] A considerable part of the smaller steam sizes is used by industries, railroads, and public utilities.
[2] U. S. Department of Commerce.
[3] Production plus imports less exports; figures for 1942–43 are corrected.
[4] Partly estimated.
[5] Data not available.
[6] An estimated one-half is used for domestic purposes.
[7] Data not yet available.
[8] Exact data not available; estimated between 55 and 77 million tons a year, including lignite.
[9] Estimated.
[10] Includes all grades of fuel oil used for heating buildings.
[11] Includes gas used for heating offices, hotels, apartments, hospitals, stores, and other large buildings, as well as houses.
[12] American Gas Association.

Distribution.—The data shown in tables 6 and 7 summarize detailed statistics on the distribution of anthracite furnished by producers and wholesalers to the Bureau of Mines in compliance with Solid Fuels Administration for War Order 7, promulgated September 28, 1943. The detailed statistics showing shipments to final destinations in the United States and Canada were published jointly by the Bureau of Mines and the Solid Fuels Administration for War in Report SFD–2, Distribution of Pennsylvania Anthracite for the Coal Year, April 1, 1943, to March 31, 1944, and were used by the Administration to insure equitable distribution of anthracite during the war period.

TABLE 6.—*Shipments of Pennsylvania anthracite, Apr. 1, 1943–Mar. 31, 1944, by States, Provinces, and countries of destination, in net tons*

[As reported by producers and wholesalers on Solid Fuels Administration for War form SFA-26]

Destination	Domestic sizes						Steam sizes						Total all sizes	
	Broken	Egg	Stove	Chestnut	Pea	Total domestic sizes	Buckwheat No. 1	Buckwheat No. 2 (Rice)	Buckwheat No. 3 (Barley)	Buckwheat No. 4	All other sizes	Total steam sizes	Net tons	Percent of total
United States:														
New England States:														
Connecticut	1,509	82,729	509,179	566,368	80,501	1,240,286	132,335	60,546	52,266			245,147	1,485,433	2.54
Maine		48,218	178,594	152,613	14,445	393,870	29,765	11,835	935		371	42,906	436,776	.75
Massachusetts	3,326	469,478	1,212,987	841,581	86,434	2,613,806	205,281	107,020	74,506	19,690	260	406,757	3,020,563	5.17
New Hampshire	43	28,826	114,077	83,153	7,500	233,599	28,995	15,034	55,819	571	1,170	101,589	335,188	.57
Rhode Island	96	49,943	164,327	140,035	24,888	379,289	36,062	14,514	1,907			52,483	431,772	.74
Vermont	476	17,355	115,585	85,868	9,929	229,213	49,321	14,820	19,005			83,146	312,359	.54
Total New England	5,450	696,549	2,294,749	1,869,618	223,697	5,090,063	481,759	223,769	204,438	20,261	1,801	932,028	6,022,091	10.31
Middle Atlantic States:														
New Jersey	3,409	251,021	1,387,388	2,344,780	751,541	4,738,139	1,100,048	798,551	1,303,015	459,464	98,546	3,759,624	8,497,763	14.55
New York	41,997	1,560,163	4,343,165	3,925,220	1,519,503	11,390,048	4,336,509	1,827,506	1,234,029	134,825	275,708	7,808,577	19,198,625	32.87
Pennsylvania:														
Excluding "local sales"	46,153	264,889	1,107,197	2,111,244	1,130,962	4,660,445	930,623	864,892	1,604,697	988,186	152,588	4,540,986	9,201,431	15.75
"Local sales"	37,469	50,684	321,721	1,135,869	1,683,378	3,229,121	727,602	851,291	1,680,376	930,087	79,810	4,269,166	7,498,287	12.84
Total Pennsylvania	83,622	315,573	1,428,918	3,247,113	2,814,340	7,889,566	1,658,225	1,716,183	3,285,073	1,918,273	232,398	8,810,152	16,699,718	28.59
Total Middle Atlantic	129,028	2,126,757	7,159,471	9,517,113	5,085,384	24,017,753	7,094,782	4,342,240	5,822,117	2,512,562	606,652	20,378,353	44,396,106	76.01
South Atlantic States:														
Delaware	916	13,811	84,659	176,377	37,284	313,047	19,474	15,824	14,279	12,283		61,860	374,907	.64
District of Columbia	50	36,682	104,830	112,855	30,731	285,148	68,883	7,355	33,956			110,194	395,342	.68
Florida and Georgia		418	1,098	723		2,239					127	127	2,366	(1)
Maryland	4,030	85,170	278,792	275,043	81,405	724,440	132,587	16,519	42,827	254	20,058	212,236	936,676	1.60
North Carolina			798	1,852	131	2,781	299			48	75	422	3,203	.01
South Carolina		834	1,747	918		3,499	25				206	231	3,730	.01
Virginia		10,077	38,623	55,819	4,989	109,508	30,752	910	1,354		227	33,243	142,751	.25
West Virginia		42	569	1,096	92	1,799	64	161		9,678	7,574	17,477	19,276	.03
Total South Atlantic	4,996	147,034	511,116	624,683	154,632	1,442,461	252,075	40,769	92,416	22,263	28,267	435,790	1,878,251	3.22

North Central States:														
Illinois		12,286	56,193	164,000	6,833	239,312	1,810	24,838	10,825	35,900	23,557	96,930	336,242	.57
Indiana		2,471	2,825	87,275	209	92,780	113	1,085	2,163		142	3,503	96,283	.16
Iowa		197	1,321	12,510	1,409	15,437	96	22			9	127	15,564	.03
Kansas and Missouri		1,982	1,729	3,958	91	7,760	236	110	2,216	9,314	1,048	12,924	20,684	.04
Michigan		12,176	71,014	117,012	2,679	202,881	6,633	23,140	15	2,134	11,888	43,810	246,691	.42
Minnesota		511	12,466	52,780	6,364	72,121	2,555	775	1,572	34,471	5,080	44,453	116,574	.20
Nebraska		28	122	3,261	49	3,460							3,460	.01
North Dakota		11	1,279	7,889	667	9,846							9,846	.02
Ohio		7,249	7,489	76,493	311	91,542	931	3,844	6,375	25,312	23,383	59,845	151,387	.26
South Dakota		30	1,348	16,823	1,086	19,287	227			35		262	19,549	.03
Wisconsin		5,880	115,193	194,698	47,605	363,376	25,521	3,182	6	103,101	46,672	178,482	541,858	.93
Total North Central		42,821	270,979	736,699	67,303	1,117,802	38,122	56,996	23,172	210,267	111,779	440,336	1,558,138	2.67
South Central States:														
Kentucky		66	18	444	44	572			89	3,819	133	4,041	4,613	.01
All others [2]		446	41	97		584			129	77	1,732	1,938	2,522	(1)
Total South Central		512	59	541	44	1,156			218	3,896	1,865	5,979	7,135	.01
Mountain and Pacific States [3]		114	763	1,270	684	2,831			53		464	517	3,348	.01
Unknown destinations [4]		45,237	287,339	348,081	128,608	809,265	78,639	40,575	7,474	2,062		128,750	938,015	1.60
All other sales		352	2,182	3,695	3,643	9,872	1,543	1,096	317			2,956	12,828	.02
Total United States	139,474	3,059,376	10,526,658	13,101,700	5,663,995	32,491,203	7,946,920	4,705,445	6,150,205	2,771,311	750,828	22,324,709	54,815,912	93.85
Canada:														
Province:														
New Brunswick	480	7,096	12,817	24,573	2,003	46,969	997	289				1,286	48,255	.08
Nova Scotia		1,102	7,241	11,412	277	20,032	44					44	20,076	.03
Ontario	15,841	327,773	921,109	736,165	82,673	2,083,561	160,714	124,159	10,582	1,441	11,120	308,016	2,391,577	4.10
Quebec		104,458	347,856	204,544	26,727	683,585	152,330	176,344	55,208	17,477	11,653	413,012	1,096,597	1.88
All other Provinces [5]			331	2,483	49	2,863	218	3,867			12	4,097	6,960	.01
Total Canada [6]	16,321	440,429	1,289,354	979,177	111,729	2,837,010	314,303	304,659	65,790	18,918	22,785	726,455	3,563,465	6.10
Other countries								17,081	181	12,351	23	29,636	29,636	.05
Grand total	155,795	3,499,805	11,816,012	14,080,877	5,775,724	35,328,213	8,261,223	5,027,185	6,216,176	2,802,580	773,636	23,080,800	58,409,013	100.00

[1] Less than 0.005 percent.
[2] Includes Alabama, Arkansas, Louisiana, Oklahoma, Tennessee, and Texas.
[3] Includes California, Montana, Nevada, New Mexico, Oregon, Utah, and Washington.
[4] Coal sold principally to over-the-road truckers for delivery outside the "local sales" area, and for which final destinations were not known.
[5] Includes Alberta, British Columbia, Manitoba, and Prince Edward Island.
[6] Shipments to final Canadian destinations as reported by American and Canadian wholesalers were as shown—3,563,465 net tons. However, the reported direct shipments by American producers and wholesalers to final Canadian destinations as well as to Canadian wholesalers was 4,071,197 net tons, broken down by size as 3,059,759 tons of domestic, 461,343 tons of Buckwheat No. 1, 438,546 tons of Rice, and 111,549 tons of all other sizes. The difference is due principally to incomplete reporting by Canadian wholesalers as to final destinations of imported coal. Official data of the United States Department of Commerce shows total exports to Canada of 4,204,740 net tons of Pennsylvania anthracite during the coal year 1943-44; this compares closely with the figure of 4,071,197 tons as reported to the Bureau of Mines by American producers and wholesalers.

Information for the 1942–43 coal year, collected in a similar manner, and published in Report SFD–1, Distribution of Pennsylvania Anthracite for the Coal Year, April 1, 1942, to March 31, 1943, was used by the Administration as the basis for its entire wartime anthracite-distribution program.

TABLE 7.—*Shipments of Pennsylvania anthracite, Apr. 1, 1943–Mar. 31, 1944 by method of movement, in net tons*

[As reported by producers and wholesalers on Solid Fuels Administration for War form SFA-26]

	Domestic sizes					
	Broken	Egg	Stove	Chestnut	Pea	Total domestic sizes
Rail	24,009	2,611,179	9,291,955	10,166,262	2,699,135	24,792,540
Tidewater	10,225	640,870	1,078,031	883,198	460,049	3,072,373
Lake		17,024	133,835	208,562	34,664	394,085
Truck [1]	292	103,238	833,084	1,360,993	603,327	2,900,934
Total retail dealers	34,526	3,372,311	11,336,905	12,619,015	3,797,175	31,159,932
All other shipments [2]	83,800	76,458	155,204	322,298	291,528	929,288
Local sales [3]	37,469	50,684	321,721	1,135,869	1,683,378	3,229,121
All other sales		352	2,182	3,695	3,643	9,872
Grand total	155,795	3,499,805	11,816,012	14,080,877	5,775,724	35,328,213

	Steam sizes						Total all sizes	
	Buckwheat No. 1	Buckwheat No. 2 (Rice)	Buckwheat No 3 (Barley)	Buckwheat No. 4	All other sizes	Total steam sizes	Net tons	Percent of total
Rail	3,548,616	2,022,113	354,569	31,256	26,560	5,983,114	30,775,654	52.69
Tidewater	2,730,250	869,138	275,647	6,499	1,286	3,882,820	6,955,193	11.91
Lake	24,020	7,518	1,668	37,299	37,476	107,981	502,066	.86
Truck [1]	428,663	208,033	82,028	43,853		762,577	3,663,511	6.27
Total retail dealers	6,731,549	3,106,802	713,912	118,907	65,322	10,736,492	41,896,424	71.73
All other shipments [2]	800,529	1,067,996	3,821,571	1,753,586	628,504	8,072,186	9,001,474	15.41
Local sales [3]	727,602	851,291	1,680,376	930,087	79,810	4,269,166	7,498,287	12.84
All other sales	1,543	1,096	317			2,956	12,828	.02
Grand total	8,261,223	5,027,185	6,216,176	2,802,580	773,636	23,080,800	58,409,013	100.00

[1] Shipments by over-the-road trucks from the mines to destinations outside the "local sales" area.
[2] Includes shipments to industrials, utilities, railroads, institutions, etc.; this tonnage was transported by all methods of movement and was not separable by type of carrier.
[3] This tonnage was transported principally by truck.

As shown in table 6, anthracite was shipped to 43 States, the District of Columbia, the Dominion of Canada, and other foreign countries in the 1943–44 coal year. Of the total anthracite shipments, 86.3 percent was destined to the New England and Middle Atlantic States; 1.6 percent, to "unknown destinations"; 5.9 percent, to all other States; and 6.2 percent, to Canada and other countries. Inasmuch as 824,000 tons of the total listed under "unknown destinations" were shipped from the mines by truck, it may be assumed that virtually all of it was destined to New York, New Jersey, and Pennsylvania. Thus, shipments to the New England and Middle Atlantic States accounted for approximately 88 percent of the total anthracite shipped to destinations in the United States, Canada, and other countries.

As shown in table 7, 72 percent of the total shipments were made to retail dealers; 13 percent moved in the "local sales" area; and the remaining 15 percent was shipped to industries, utilities, railroads, Government agencies, and institutions, etc., outside the "local sales" area. It will be noted that of the total tonnage shipped to retailers, 90 percent, or 37,891,481 tons, was Buckwheat No. 1 and larger sizes which customarily are used almost entirely for space-heating purposes. Of the anthracite shipped to retail dealers, 73 percent moved all-rail, 9 percent by truck, 17 percent by tidewater, and 1 percent was shipped off the Lake docks. The New England and Middle Atlantic States received 83 percent of all the shipments to retail dealers in the United States and Canada in the coal year 1943–44. Nearly all of the coal moving by tidewater was shipped from the New Jersey piers to the greater New York area, while a relatively small tonnage moved by water to the New England States.

According to data compiled from records of the Pennsylvania State Department of Mines, anthracite shipments from the mine to destinations in the United States declined 14 percent in 1945 from 1944. Of the total United States shipments, 84 percent moved from the mines by rail and 16 percent by truck, whereas in 1944, 86 percent moved by rail and 14 percent by truck. Pennsylvania received 81 percent of the truck shipments in 1945; New Jersey and New York followed with 9 percent and 8 percent, respectively. Anthracite rail shipments, by destinations, for 1943–45 are shown in table 8 and truck movement in 1945, by months, and by States of destination, in table 9.

According to data compiled from records of the Massachusetts Division on the Necessaries of Life and the Anthracite Emergency Tidewater Bureau, rail receipts of Pennsylvania anthracite in 1945 in New England declined 19 percent from 1944; tidewater receipts decreased 14 percent. Details on anthracite movement to New England are given in table 10. Loadings at Lake Erie ports increased 16 percent and receipts at the Upper Lake docks, 37 percent over 1944. The substantial gains in Lake Erie loadings in 1944 and 1945 over previous years are due largely to the increased use of the smaller steam sizes of anthracite by briquet manufacturers in the Great Lakes region.

TABLE 8.—*Rail shipments of Pennsylvania anthracite, 1943–45, by destinations, in net tons* [1]

[Truck shipments excluded]

Destination	1943	1944	1945
New England States	5,603,946	6,003,552	4,867,051
New York	17,812,425	16,821,928	13,867,150
New Jersey	8,632,278	9,465,559	7,963,782
Pennsylvania	10,528,699	11,693,186	9,647,371
Delaware	278,539	317,539	297,056
Maryland	760,497	905,993	784,863
District of Columbia	310,782	323,923	269,278
Virginia	108,764	147,013	128,642
Ohio	125,117	136,781	109,508
Indiana	93,215	85,124	87,123
Illinois	338,196	463,936	529,549
Wisconsin	460,020	392,696	470,501
Minnesota	179,647	146,857	108,210
Michigan	298,873	245,751	239,031
Other States	81,650	64,325	72,573
Total United States	45,612,648	47,214,163	39,441,688
Canada	3,600,508	3,675,870	3,059,062
Other foreign countries	15,711	5,118	16,079
Grand total	49,228,867	50,895,151	42,516,829

[1] Pennsylvania Department of Mines.

TABLE 9.—*Truck shipments of Pennsylvania anthracite in 1945, by months, and by States of destination, in net tons* [1]

Destination	January	February	March	April	May	June	July
Pennsylvania:							
Within region	499,612	472,390	346,810	404,933	162,891	346,012	281,189
Outside region	170,367	195,332	140,552	168,664	85,173	181,832	161,268
New York	52,598	52,054	44,286	48,588	27,119	72,266	68,953
New Jersey	61,440	67,166	64,947	71,395	24,570	61,449	58,572
Delaware	5,733	6,112	5,030	2,432	1,569	2,118	2,775
Maryland	8,397	8,481	3,707	10,456	3,900	12,000	8,891
District of Columbia	200		328		15	54	
Other States	1,551	1,530	788	1,306	522	1,262	1,174
Total: 1945	799,898	803,065	606,448	707,774	305,759	676,993	582,822
1944	676,373	670,672	780,122	604,203	547,505	597,388	522,947

Destination	August	September	October	November	December	Total	Percent of total trucked
Pennsylvania:							
Within region	297,578	294,114	354,025	309,026	440,565	4,209,145	55.4
Outside region	158,891	166,749	168,727	142,258	180,139	1,919,952	25.3
New York	73,818	34,855	40,030	35,904	69,906	620,377	8.2
New Jersey	65,818	57,824	56,118	49,660	63,461	702,420	9.2
Delaware	3,094	7,864	2,967	2,897	3,109	45,700	.6
Maryland	8,135	2,906	5,529	3,029	7,993	83,424	1.1
District of Columbia		22	33		16	668	(2)
Other States	1,334	1,307	1,452	1,032	1,165	14,423	.2
Total: 1945	608,668	565,641	628,881	543,806	766,354	7,596,109	100.0
1944	626,861	661,313	713,266	667,153	645,175	7,712,978	100.0

[1] Compiled from reports of Pennsylvania Department of Mines.
[2] Less than 0.05 percent.

TABLE 10.—*Receipts of anthracite in New England, 1917, 1920, 1923, and 1927–45, in thousands of net tons*

Year	Receipts by tidewater [1]						Receipts by rail [1]	Imports [2]	Total receipts of Pennsylvania anthracite [3]
	Maine	New Hampshire	Massachusetts	Rhode Island	Connecticut	Total			
1917	432	47	2,222	555	1,165	4,421	7,259	1	11,679
1920	307	6	2,015	450	743	3,521	7,804	1	11,324
1923	437	27	2,216	511	891	4,082	8,102	145	12,039
1927	242	33	1,220	311	615	2,421	6,725	106	9,040
1928	205	35	1,373	301	528	2,442	6,934	369	9,007
1929	237	17	1,227	329	450	2,260	6,781	483	8,558
1930	275	17	1,236	271	422	2,221	6,169	658	7,732
1931	164	18	1,125	282	348	1,937	5,125	611	6,451
1932	148	10	1,014	212	275	1,659	3,980	574	5,065
1933	195	7	1,027	202	259	1,690	3,562	443	4,809
1934	168	20	946	190	266	1,590	4,382	477	5,495
1935	121	7	802	205	237	1,372	4,030	559	4,843
1936	127	14	792	198	267	1,398	3,889	612	4,675
1937	81	11	604	152	200	1,048	3,713	395	4,366
1938	93	2	554	137	191	977	3,491	363	4,105
1939	74	3	488	83	227	875	4,027	298	4,604
1940	48	4	350	74	172	648	4,174	135	4,687
1941	57	9	348	58	210	682	4,870	75	5,477
1942	(4)	(4)	(4)	(4)	(4)	581	5,393	139	5,835
1943						575	5,310	164	5,721
1944						398	5,836	12	6,222
1945						331	4,750	(5)	5,081

[1] Commonwealth of Massachusetts, Division on the Necessaries of Life.
[2] U. S. Department of Commerce.
[3] Total receipts by rail and by tidewater less imports.
[4] Data not available.
[5] Less than 1,000 tons.

Shipments of anthracite from the Lehigh, Schuylkill, and Wyoming regions, 1850 to 1945, inclusive, are presented graphically in figure 1.

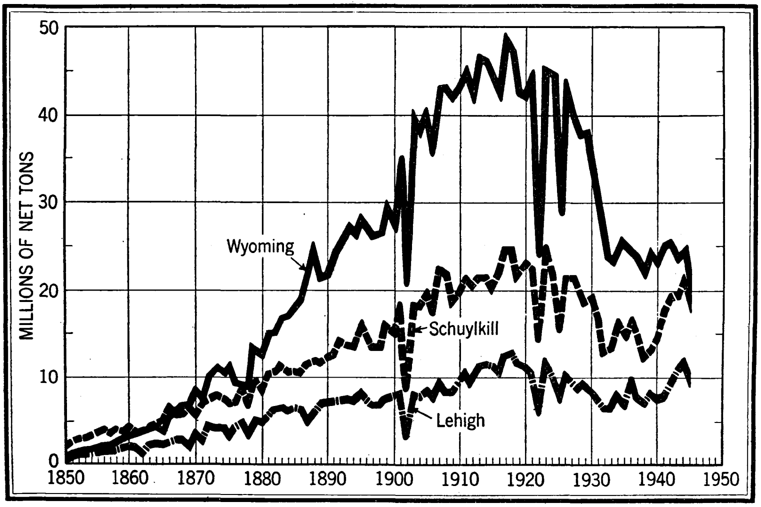

FIGURE 1.—Anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1850–1945.

Consumption.—Consumption of anthracite in the United States in 1945 totaled 51,600,000 net tons, compared with 59,400,000 tons in 1944. These statistics include colliery fuel and coal dredged from the streams draining the anthracite region and are based on production, imports, exports, and changes in producers' stocks but do not consider changes in stocks held by retail dealers, as data on stocks held by this group are incomplete. Owing largely to a shortage of low-volatile bituminous coal for use in the manufacture of fuel briquets and packaged fuel, the consumption of anthracite by these industries increased from 388,693 net tons in 1943 to more than 900,000 tons in 1945. The consumption of anthracite by class I railroads and electric power utilities declined 8 percent and 9 percent, respectively, in 1945 compared with 1944.

Changes in stocks.—Producers' stocks declined from 444,508 net tons in 1944 to 130,135 tons in 1945. Almost all of the coal in producers' yards was Buckwheat No. 3 and No. 4 sizes, which are ordinarily used for industrial purposes, and virtually no Buckwheat No. 1 or larger sizes of anthracite, commonly used for space heating, was available at the end of the year. Stocks held by public utilities declined 4 percent from 1944 and those held by class I railroads 42 percent. Stocks of anthracite on the Upper Lake docks in 1945 increased 64 percent over 1944. Stocks in retail dealers' yards amounted to 11 days supply in January and at the close of the year 13 days.

"Bootleg" coal.—According to the Anthracite Committee, production of "bootleg" coal in 1945 totaled 1,026,000 net tons, compared with 1,332,957 tons in 1944 and the record production of 6,300,000 tons in 1941. A survey by the committee in March 1946 revealed that 526 "bootleg" holes were being worked by 1,939 men, a substantial decrease from the 10,762 men working 3,006 holes disclosed by the committee's survey in March 1941. The decline in "bootleg" mining since 1941 is due largely to the efforts of the Anthracite Committee to decrease this kind of mining and to many of the younger "bootleg" miners entering the armed forces and nearby industries.

Early in 1945 a bill was introduced before the Pennsylvania General Assembly requiring inspections by the Pennsylvania Department of Mines of all mine openings employing two or more men. The present law requires periodic inspection only of those mines employing five or more men. The legislature adjourned without passing this measure. Had it become law, it might have been the means of drastically curtailing "bootleg" operations, since these mines would have difficulty in meeting the rigid inspection standards of the Pennsylvania Department of Mines. In 1941, 61 men were killed in the "bootleg" mining industry, and in 1945, 16 fatalities occurred. The death rate in this kind of mining in 1945 of 1 fatality for every 64,000 tons mined was much higher than the accident rate in recognized anthracite mines. Statistical details on "bootleg" mining for 1941–45 are given in table 11.

TABLE 11.—*Statistics of "bootleg" operations in the Pennsylvania anthracite industry, 1941–45*

Year	Production (net tons) [1]	Purchased for preparation by recognized operations (net tons) [2]	Number of fatalities [1]
1941	6,300,000	1,902,481	61
1942	3,931,000	2,616,839	45
1943	1,912,467	1,265,617	22
1944	1,332,957	506,842	21
1945	1,026,000	260,342	16

[1] Anthracite Committee, Harrisburg, Pa.
[2] As reported to Federal Bureau of Mines.

Trend in employment.—The number of men employed in the anthracite-mining industry declined from an average of 77,591 in 1944 to 72,842 in 1945. The shortage of labor, especially of men to work at the face, was acute; and output, no doubt, would have been much greater had enough labor been available. During the latter part of the year, many younger men returned to the mines from war service, but this did not increase materially the total number of miners employed because some of the older men who worked in the mines during the war to help out during the emergency became inactive. These figures on employment do not include men working in "bootleg" holes; for employment in this type of mining, see table 12. Data on employment in recognized operations are given in tables 28 and 29.

Sales realization.—The average sales realization on anthracite breaker shipments in 1945 was $6.26 per net ton, compared with $5.91 a ton in 1944, while the average value per ton on total anthracite output was $5.90, against $5.57 in 1944. These gains were due to increased f. o. b. mine prices granted by the Office of Price Administration to the producers to compensate them for added costs of production under the wage agreement of May 19 and for other general higher operating costs.

TABLE 12.—*Survey of "bootleg" operations in the Pennsylvania anthracite industry, 1941–46* [1]

Date of survey	Number of "bootleg" operations	Average number of men employed
Mar. 31, 1941	3,006	10,762
May 1, 1942	2,029	7,554
Dec. 15, 1942	1,363	4,967
Apr. 20, 1943	1,065	3,607
Oct. 14, 1943	791	2,725
Mar. 31, 1944	652	2,220
Mar. 7, 1945	502	1,806
Mar. 30, 1946	526	1,939

[1] Anthracite Committee, Harrisburg, Pa.

Trend in prices.—To compensate the anthracite producers for added costs of production under the wage agreement of May 19, the Office of Price Administration authorized increases in f. o. b. mine prices effective June 18 as follows: $1.00 per net ton on Broken, Egg, Stove, and Chestnut sizes; $0.85 on Pea; $0.50 on Buckwheat No. 1 and Rice; and $0.25 on Barley and smaller sizes. The increases resulted in new mine prices of $8.85 per net ton for Broken, Egg, Stove, and Chestnut sizes; $7.15 per ton for Pea; $5.15 for Buckwheat No. 1; $4.25 for Rice; $3.00 for Barley; and $2.25 for smaller sizes. On December 1, 1945, the Office of Price Administration granted additional price relief to the producers when it established different prices for groups of companies. Group 1 prices were applicable to the nine larger anthracite-producing companies, and group 2, with a few exceptions, to all other anthracite producers. The procedure of applying different prices to groups of producers was followed in World War I, when a number of the large companies were given lower prices than other producers at that time. The new prices in effect at the end of 1945 are shown in table 13.

TABLE 13.—*Maximum prices per net ton for Pennsylvania anthracite, as established by the Office of Price Administration, effective December 1, 1945*

	Broken	Egg	Stove	Chestnut	Pea	Buckwheat No. 1	Buckwheat No. 2 (Rice)	Buckwheat No. 3 (Barley)	All other sizes
Group 1: Glen Alden Coal Co.; Lehigh Valley Coal Co.; Lehigh Navigation Coal Co.; Jeddo Highland Coal Co.; Pennsylvania Coal Co.; Philadelphia & Reading Coal & Iron Co.; Susquehanna Collieries Co.; Stevens Coal Co.; Hudson Coal Co.	$9.00	$9.00	$9.00	$9.00	$7.30	$5.25	$4.30	$3.05	[1] $2.25
Group 2: All producers not included in group 1	9.50	9.50	9.50	9.50	7.80	5.70	4.60	3.35	[1] 2.25
Exceptions:									
Jeddo Highland Coal Co.: Anthracite prepared at Jeddo No. 7 and Highland No. 5 breakers. Sold under trade name "Jeddo Coal," "Highland Coal," or "Hazel Brook Coal"	9.25	9.25	9.25	9.25	7.55	5.50	4.45	3.05	2.25
Franklin-Lykens Coal Co.: Anthracite prepared at Williamstown breaker. Sold under trade name "The Only Genuine Franklin Coal of Lykens Valley"	9.75	10.00	10.25	9.50	7.80	5.70	4.60	3.35	2.25
Lehigh Naviagion Coal Co.: Anthracite sold under trade name "Old Company's Lehigh-Greenwood Premium Anthracite"	9.00	9.25	9.25	9.25	7.55	5.25	4.30	3.05	2.25

[1] If sold for fuel or sintering use, or for use in the manufacture of calcium carbide, graphite, or activated carbon, including (specifically but not exclusively) Buckwheat No. 4, river or dredge Barley, and smaller sizes.

Retail prices of anthracite, bituminous coal, coke, and heating oils in selected cities, by months, in 1945 are shown in table 14. These prices were compiled from reports of the Bureau of Labor Statistics, United States Department of Labor.

Imports and exports.—Exports of anthracite, virtually all of which were destined to Canada, declined 12 percent in 1945 from 1944. Imports were negligible, totaling only 149 net tons. For details on imports and exports see tables 36 and 37.

Mechanical stokers and oil burners.—According to the Bureau of the Census, United States Department of Commerce, factory sales of class 1 mechanical stokers for burning anthracite (capacity under 61 pounds of coal per hour) increased from 450 units in 1944 to 3,325 units in 1945. Sales of this capacity stoker totaled 17,110 units in 1941. Sales of class 2 stokers (capacity 61 to 100 pounds of anthracite per hour) totaled 1,883, a decline of 16 percent from the 2,243 units sold in 1944. Shipments of oil burners for central heating plants and industrial uses totaled 182,130 in 1945 compared with 77,081 in 1944 and 303,869 in 1941. With the lifting of Government restrictions and the settling of labor strife in plants making electric motors and other burner equipment, it is expected that sales of both stokers and oil burners will increase greatly in 1946 over the war years.

TABLE 14.—*Retail prices of selected fuels in 1945, by cities and months* [1]

[Coal and coke, per net ton; heating oil, per 100 gallons]

City and fuel	January	February	March	April	May	June	July	August	September	October	November	December
Baltimore, Md.:												
Anthracite:												
Stove	$13.14	$13.26	$13.30	$13.14	$13.14	$13.15	$14.15	$14.15	$14.15	$14.16	$14.15	$14.28
Buckwheat No. 1	10.10	10.23	10.26	10.11	10.11	10.21	10.71	10.70	10.70	10.70	10.70	10.79
Bituminous coal, low-volatile Stove	10.96	11.04	11.04	10.87	11.13	11.15	11.13	11.15	11.15	11.15	11.15	11.15
Coke, Egg	----	----	----	----	----	----	----	----	----	----	----	----
Heating oil:												
Fuel oil No. 2	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	7.50	7.50	7.50	7.50
Fuel oil No. 3	----	----	----	----	----	----	----	----	----	----	----	----
Boston, Mass.:												
Anthracite:												
Stove	15.64	15.79	15.84	15.64	15.64	15.64	16.64	16.64	16.64	16.66	16.66	16.76
Buckwheat No. 1	11.94	12.09	12.14	11.96	11.94	11.94	12.44	12.44	12.44	12.44	12.44	12.52
Bituminous coal, low-volatile Stove	----	----	----	----	----	----	----	----	----	----	----	----
Coke, Egg	14.99	15.14	15.19	14.99	14.81	14.83	14.79	15.19	15.19	15.19	15.19	15.19
Heating oil:												
Fuel oil No. 2	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	7.58	7.60	7.60	7.60
Fuel oil No. 3	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	7.60	7.60	7.60	7.60
Buffalo, N. Y.:												
Anthracite:												
Stove	13.52	13.60	13.62	13.52	13.52	13.52	13.62	14.52	14.52	14.52	14.79	14.92
Buckwheat No. 1	9.68	9.75	9.78	9.68	9.68	9.68	9.72	10.18	10.18	10.18	10.44	10.53
Bituminous coal, low-volatile Stove	----	----	----	----	----	----	----	----	----	----	----	----
Coke, Egg	11.24	11.24	11.24	11.24	11.24	11.24	11.24	11.54	11.54	11.54	11.54	11.54
Heating oil:												
Fuel oil No. 2	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	8.50	8.50	8.50	8.50
Fuel oil No. 3	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50	8.50	8.50	8.50	8.50
Chicago, Ill.: [2]												
Anthracite:												
Stove	16.84	16.84	16.84	16.84	16.84	16.84	17.84	17.84	17.84	17.84	17.84	17.97
Buckwheat No. 1	13.49	13.49	13.49	13.49	13.49	13.49	13.99	13.99	13.99	13.99	13.99	14.06
Bituminous coal, low-volatile Stove	12.57	12.57	12.57	12.57	12.85	12.85	12.85	12.89	12.89	12.89	12.89	12.89
Coke, Egg	15.09	15.09	15.09	15.09	15.09	15.09	15.09	15.45	15.41	15.44	15.44	15.49
Heating oil:												
Fuel oil No. 2	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.19	7.19	7.40	7.45
Fuel oil No. 3	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.18	7.18	7.41	7.45
Milwaukee, Wis.:												
Anthracite:												
Stove	15.46	15.46	15.46	15.46	15.46	15.46	16.46	16.33	16.46	16.46	16.46	16.46
Buckwheat No. 1	12.26	12.26	12.26	12.26	12.26	12.26	12.70	12.63	12.76	12.76	12.76	12.76
Bituminous coal, low-volatile Stove	13.28	13.28	13.25	13.25	13.27	13.44	13.43	13.43	13.43	13.44	13.46	13.49
Coke, Egg	13.71	13.71	13.72	13.72	13.72	13.79	13.79	14.19	14.19	14.19	14.19	14.19

See footnotes at end of table.

TABLE 14.—*Retail prices of selected fuels in 1945, by cities and months* [1]—Continued

[Coal and coke, per net ton; heating oil, per 100 gallons]

City and fuel	January	February	March	April	May	June	July	August	September	October	November	December
Milwaukee, Wis.—Continued												
Heating oil:												
Fuel oil No. 2	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$8.00	$7.70	$7.70	$8.00	$8.00
Fuel oil No. 3	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	7.70	7.70	8.00	8.00
New York, N. Y.:[3]												
Anthracite:												
Stove	13.99	14.09	13.99	13.99	13.99	13.99	15.01	15.02	15.05	15.05	15.03	15.18
Buckwheat No. 1	9.82	9.93	9.82	9.82	9.82	9.82	10.34	10.35	10.36	10.36	10.34	10.44
Bituminous coal, low-volatile Stove	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Coke, Egg	14.73	14.81	14.73	14.73	14.90	14.90	14.88	14.88	14.79	14.79	15.01	15.01
Heating oil:												
Fuel oil No. 2	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	7.58	7.58	7.58	7.60
Fuel oil No. 3	9.09	9.09	9.09	9.09	9.09	9.09	-----	-----	-----	-----	-----	-----
Philadelphia, Pa.:												
Anthracite:												
Stove	13.13	13.40	13.41	13.17	13.13	13.10	14.24	14.25	14.29	14.26	14.26	14.40
Buckwheat No. 1	9.68	9.95	9.96	9.72	9.68	9.65	10.28	10.30	10.34	10.31	10.31	10.40
Bituminous coal, low-volatile Stove	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Coke, Egg	12.82	13.07	13.05	12.67	12.55	12.51	12.51	12.56	12.91	12.91	12.91	12.91
Heating oil:												
Fuel oil No. 2	8.93	8.93	8.93	8.93	8.93	8.93	8.93	8.93	7.43	7.43	7.43	7.43
Fuel oil No. 3	8.91	8.91	8.91	8.91	8.91	8.91	8.91	8.91	7.41	7.41	7.41	7.41
Portland, Maine:												
Anthracite:												
Stove	15.63	15.63	15.63	15.63	15.63	15.63	16.63	16.63	16.63	16.63	16.63	16.78
Buckwheat No. 1	11.68	11.68	11.68	11.68	11.68	11.68	12.18	12.18	12.18	12.18	12.18	12.28
Bituminous coal, low-volatile Stove	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Coke, Egg	14.83	14.83	14.83	14.83	14.68	14.68	14.68	15.10	15.10	15.10	15.10	15.08
Heating oil:												
Fuel oil No. 2	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	7.50	7.50	7.50	7.53
Fuel oil No. 3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Washington, D. C.:[4]												
Anthracite:												
Stove	14.95	15.13	15.14	13.36	13.36	13.36	14.25	14.36	14.36	14.36	14.36	14.49
Buckwheat No. 1	11.05	11.23	11.23	9.96	9.87	9.87	10.37	10.37	10.37	10.38	10.38	10.48
Bituminous coal, low-volatile Stove	12.26	12.46	12.46	10.93	11.19	11.19	11.19	11.23	11.23	11.23	11.23	11.23
Coke, Egg	13.54	13.66	13.66	13.54	13.54	13.54	13.54	13.54	13.54	13.54	13.54	13.54
Heating oil:												
Fuel oil No. 2	9.40	9.40	9.40	9.40	9.40	9.40	9.40	9.40	7.90	7.90	7.90	7.90
Fuel oil No. 3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Compiled from reports of Bureau of Labor Statistics, U. S. Department of Labor. Prices are as of the 15th of each month. Data are preliminary.
[2] Includes 2 percent sales tax.
[3] Includes 1 percent sales tax.
[4] January–March, prices of coal per ton of 2,240 pounds.

OUTLOOK

The outlook for the Pennsylvania anthracite industry in 1946 is encouraging. It is expected that production will be close to the demand and that the markets will absorb the available supply. Subsequent to 1946, competition among anthracite, heating oils, natural and manufactured gas, coke, and bituminous coal will be extremely keen, and the relative position of the industry will depend largely on its ability to develop low-cost, automatic coal-burning equipment, to find new uses for anthracite, and to reduce mining costs. Low-cost, automatic coal-burning equipment is not only a means of obtaining new business, but installations of both burners and auxiliary equipment will aid in retaining old customers. Concentrated marketing and merchandising programs should be continued; and the industry must work closely with architects, builders, and manufacturers of anthracite heating equipment to insure itself a fair share of the fuel business created by the millions of new homes which it is expected will be built during the next 10 years.

SOURCES AND ACKNOWLEDGMENTS

Final statistics of the Pennsylvania anthracite-mining industry are prepared from an annual canvass, by mail, of the producers and shippers of anthracite. About 98 percent of the tonnage is reported direct, and the remaining 2 percent is collected by personal visits or from reliable collateral evidence. The data on individual operations are furnished voluntarily by the producers and treated confidentially, as is customary in the statistical services of the Bureau of Mines.

In compiling available information, pertinent statistics prepared by the Pennsylvania Department of Mines, the Anthracite Committee, the Anthracite Institute, and the Association of American Railroads have been used to advantage. The Bureau of Mines gratefully acknowledges the cooperation of these organizations and others from whom information has been received.

PRODUCTION

The production statistics of the Pennsylvania anthracite industry contained in this chapter include coal from five sources—deep mines, strip pits, culm banks, coal purchased from "bootleg" mines, and river or creek coal recovered from the streams draining the anthracite fields. A small quantity of semianthracite produced in Sullivan County (181,315 net tons in 1945) is included also for historical comparison. The total production from these sources in 1945 was 54,933,909 net tons, a 14-percent decline from the 1944 output of 63,701,363 tons. In addition to the production of 54,933,909 net tons, the industry reported 217,363 tons of slush; that is, the settlings from the water used in cleaning anthracite. The marketing of this material, a necessity occasioned by the shortage of coal during 1945, probably will be discontinued in the postwar period. As this coal was generally unprepared, the average value received for it was only about 40 cents per ton compared with $1.78 a ton for the Buckwheat

717372—47——60

No. 4 size, and it was excluded from the tables in this chapter to avoid distortion of production statistics and keep the data comparable with those of previous years. See tables 17 to 22 for production and shipments by fields, regions, and counties.

Before 1941 "bootleg" coal was not included in the production statistics of the anthracite industry by the Bureau of Mines; however, in 1941 the Anthracite Committee inaugurated a plan whereby recognized operators purchased lawfully the run-of-mine output of "bootleg" holes for preparation at their plants and shipment to market. In 1944 these shipments totaled 506,842 net tons; in 1945 the purchases were 260,342 tons. It would be impossible to segregate this purchased "bootleg" coal from the output of the recognized industry; it is, therefore, included in the various production tables in the Minerals Yearbook chapters on Pennsylvania anthracite for 1941–45. No attempt has been made to include in the statistics "bootleg" coal other than that purchased by recognized operators. To compute the output per man per day for the anthracite industry in 1941–45 it was necessary to deduct the "bootleg" purchases from the total tonnage shipped by the recognized industry, since adequate data on man-hours required to produce the "bootleg" tonnage are not available. Details of this procedure are discussed in this chapter under Labor Statistics.

Weeks and months.—Tables 15 and 16 summarize the statistics of weekly and monthly production of anthracite. Statistics of current output are estimated from records of carloadings and from tonnage reports from trade sources. The weekly and monthly figures have been adjusted to the annual total ascertained by direct canvass of the operators.

TABLE 15.—*Estimated weekly production of Pennsylvania anthracite in 1945*

Week ended—	Net tons	Week ended—	Net tons
Jan. 6	784,000	July 21	1,159,000
Jan. 13	1,115,000	July 28	1,196,000
Jan. 20	999,000	Aug. 4	1,213,000
Jan. 27	956,000	Aug. 11	1,184,000
Feb. 3	842,000	Aug. 18	498,000
Feb. 10	1,120,000	Aug. 25	1,168,000
Feb. 17	1,146,000	Sept. 1	1,204,000
Feb. 24	1,142,000	Sept. 8	913,000
Mar. 3	1,122,000	Sept. 15	1,144,000
Mar. 10	1,113,000	Sept. 22	1,149,000
Mar. 17	1,221,000	Sept. 29	1,237,000
Mar. 24	1,210,000	Oct. 6	1,162,000
Mar. 31	1,189,000	Oct. 13	1,208,000
Apr. 7	1,042,000	Oct. 20	1,237,000
Apr. 14	1,253,000	Oct. 27	1,258,000
Apr. 21	1,295,000	Nov. 3	854,000
Apr. 28	1,316,000	Nov. 10	1,179,000
May 5	279,000	Nov. 17	1,047,000
May 12	46,000	Nov. 24	954,000
May 19	45,000	Dec. 1	1,138,000
May 26	1,230,000	Dec. 8	1,021,000
June 2	1,111,000	Dec. 15	1,088,000
June 9	1,272,000	Dec. 22	933,000
June 16	1,290,000	Dec. 29	642,000
June 23	1,359,000	Dec. 31	[1] 140,000
June 30	1,336,000		
July 7	913,000	Calendar year	54,934,000
July 14	1,262,000		

[1] Figures represent output of working days in that part of week included in calendar year 1945. Preliminary production for week of January 5, 1946, was 737,000 tons.

Reconciliation of fresh-mined, culm-bank, and breaker product.—Anthracite is now produced from three principal sources—mines (deep, bootleg, and strip-pit), culm banks, and rivers that drain the anthracite region. As all three sources contribute to the country's supply, it is important to consider them to ascertain the total production. No difficulty is experienced in separating the figures of production by dredges, as this is a distinct industry. It is difficult, however, to make a sharp differentiation between fresh-mined and culm-bank coal, continuity of which must be maintained in the statistical history of the industry. As the best solution of this problem, the individual breaker, washery, or dredge is taken as the unit in compiling the statistics, and the producing companies are asked to supply separate statements for each. These are totaled to form the primary tables of this report to show the total quantity of breaker product, washery product, and dredge product, with related figures of value and number of employees.

TABLE 16.—*Estimated monthly production of Pennsylvania anthracite, 1938–45, in thousands of net tons* [1]

Month	1938	1939	1940	1941 [2]	1942 [2]	1943 [2]	1944 [2]	1945 [2]
January	4, 978	5, 019	5, 783	5, 162	4, 560	4, 466	4, 970	4, 219
February	3, 646	4, 169	3, 648	4, 596	4, 801	5, 203	5, 811	4, 471
March	4, 257	3, 652	3, 881	4, 765	5, 116	5, 855	5, 512	5, 269
April	3, 149	5, 367	3, 853	3, 317	5, 185	5, 337	5, 141	5, 124
May	4, 400	5, 141	4, 070	4, 001	4, 873	5, 219	5, 781	2, 083
June	4, 450	3, 577	4, 492	5, 072	5, 153	3, 244	5, 558	5, 667
July	2, 580	2, 951	4, 534	4, 855	5, 374	5, 698	4, 905	4, 944
August	2, 735	3, 883	3, 883	5, 441	5, 212	5, 653	5, 558	4, 656
September	3, 388	4, 840	4, 172	5, 334	5, 459	5, 474	5, 380	4, 640
October	4, 180	4, 985	4, 355	5, 580	5, 132	5, 359	5, 538	5, 304
November	3, 803	3, 989	3, 980	3, 974	4, 824	4, 140	5, 029	4, 559
December	4, 533	3, 914	4, 834	4, 271	4, 639	4, 996	4, 518	3, 998
	46, 099	51, 487	51, 485	56, 368	60, 328	60, 644	63, 701	54, 934

[1] Production is estimated from weekly carloadings as reported by the Association of American Railroads and includes mine fuel, coal sold locally, and dredge coal.
[2] Includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.

TABLE 17.—*Pennsylvania anthracite produced, 1941–45, by fields, in net tons*

[The figures of breaker product include a certain quantity of culm-bank coal, which amounted to 6,236,300 tons in 1945]

Field	1941	1942	1943	1944	1945
Eastern Middle:					
Breakers	5, 066, 892	5, 717, 908	6, 140, 224	5, 905, 623	[1] 5, 005, 245
Washeries	217, 642	259, 378	356, 450	403, 688	[1] 342, 116
Dredges	5, 032				
Total Eastern Middle	5, 289, 566	5, 977, 286	6, 496, 674	6, 309, 311	5, 347, 361
Western Middle:					
Breakers	11, 531, 105	13, 122, 774	12, 577, 769	12, 721, 704	11, 540, 524
Washeries	946, 794	333, 089	280, 525	538, 875	130, 789
Dredges	531, 129	466, 339	442, 608	385, 137	308, 976
Total Western Middle	13, 009, 028	13, 922, 202	13, 300, 902	13, 645, 716	11, 980, 289
Southern:					
Breakers	7, 445, 528	8, 797, 539	10, 519, 946	12, 194, 069	10, 916, 769
Washeries	1, 116, 438	1, 326, 087	1, 486, 803	2, 091, 473	1, 373, 578
Dredges	975, 457	794, 627	879, 379	983, 046	896, 250
Total Southern	9, 537, 423	10, 918, 253	12, 886, 128	15, 268, 588	13, 186, 597

TABLE 17.—*Pennsylvania anthracite produced, 1941–45, by fields, in net tons*—Con.

Field	1941	1942	1943	1944	1945
Northern:					
Breakers	28, 097, 833	29, 269, 471	[1] 27,417, 425	27, 794, 639	[1] 23, 503, 306
Washeries	391, 452	168, 237	[1] 432, 021	531, 338	[1] 735, 041
Dredges	5, 945	24, 067	12, 750	4, 554	----------
Total Northern	28, 495, 230	29, 461, 775	27, 862, 196	28, 330, 531	24, 238, 347
Total, excluding Sullivan County:					
Breakers	52, 141, 358	56, 907, 692	[1] 56,655, 364	58, 616, 035	[1] 50, 965, 844
Washeries	2, 672, 326	2, 086, 791	[1] 2, 555, 799	3, 565, 374	[1] 2, 581, 524
Dredges	1, 517, 563	1, 285, 033	1, 334, 737	1, 372, 737	1, 205, 226
Total, excluding Sullivan County	56, 331, 247	60, 279, 516	60, 545, 900	63, 554, 146	54, 752, 594
Sullivan County:					
Breakers	37, 020	48, 213	97, 720	147, 217	149, 505
Washeries	----------	----------	----------	----------	31, 810
Total Sullivan County	37, 020	48, 213	97, 720	147, 217	181, 315
Grand total	56, 368, 267	60, 327, 729	60, 643, 620	63, 701, 363	54, 933, 909

[1] Small quantity of washery coal included with breaker.

TABLE 18.—*Pennsylvania anthracite shipped, sold locally, and used as colliery fuel in 1945, by regions*

Region	Shipments		Local sales		Colliery fuel		Total	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Lehigh:								
Breakers	9, 330, 777	$55, 127, 053	517, 788	$3, 670, 917	[2] 291, 549	[2] $918, 403	[2] 10, 140, 114	[2] $59,716,373
Washeries	324, 603	1, 417, 332	17, 513	110, 779	(2)	(2)	[2] 342, 116	[2] 1, 528, 111
Dredges	41, 409	70, 439	----------	----------	----------	----------	41, 409	70, 439
Total Lehigh	9, 696, 789	56, 614, 824	535, 301	3, 781, 696	291, 549	918, 403	10, 523, 639	61, 314, 923
Schuylkill:								
Breakers	16, 269, 190	94, 506, 924	765, 845	5, 079, 299	287, 389	610, 899	17, 322, 424	100, 197, 122
Washeries	1, 475, 767	6, 158, 155	18, 908	64, 607	9, 692	25, 532	1, 504, 367	6, 248, 294
Dredges	699, 910	1, 083, 963	462, 334	767, 107	1, 573	2, 639	1, 163, 817	1, 853, 709
Total Schuylkill	18, 444, 867	101, 749, 042	1, 247, 087	5, 911, 013	298, 654	639, 070	19, 990, 608	108, 299, 125
Wyoming:								
Breakers	19, 540, 527	132, 891, 322	[2] 2,451,683	[2] 15, 711, 851	1, 511, 096	2, 777, 152	[2] 23, 503, 306	[2] 151,380,325
Washeries	719, 346	1, 883, 003	(2)	(2)	15, 695	46, 817	[2] 735, 041	[2] 1, 929, 820
Total Wyoming	20, 259, 873	134, 774, 325	2, 451, 683	15, 711, 851	1, 526, 791	2, 823, 969	24, 238, 347	153, 310, 145
Total, excluding Sullivan County:								
Breakers	45, 140, 494	282, 525, 299	[2] 3,735,316	[2] 24, 462, 067	[2] 2,090,034	[2] 4,306,454	[2] 50, 965, 844	[2] 311,293,820
Washeries	2, 519, 716	9, 458, 490	[2] 36, 421	[2] 175, 386	[2] 25, 387	[2] 72, 349	[2] 2, 581, 524	[2] 9, 706, 225
Dredges	741, 319	1, 154, 402	462, 334	767, 107	1, 573	2, 639	1, 205, 226	1, 924, 148
Total, excluding Sullivan County	48, 401, 529	293, 138, 191	4, 234, 071	25, 404, 560	2, 116, 994	4, 381, 442	54, 752, 594	322, 924, 193
Sullivan County: [3]								
Breakers	109, 212	636, 510	39, 793	234, 799	500	1, 600	149, 505	872, 909
Washeries	31, 710	147, 183	----------	----------	100	150	31, 810	147, 333
Total Sullivan County	140, 922	783, 693	39, 793	234, 799	600	1, 750	181, 315	1, 020, 242
Grand total:								
1945	48, 542, 451	293, 921, 884	4, 273, 864	25, 639, 359	2, 117, 594	4, 383, 192	54, 933, 909	323, 944, 435
1944	57, 640, 570	328, 909, 170	3, 765, 641	21, 283, 433	2, 295, 152	4, 390, 281	63, 701, 363	354, 582, 884
Change, 1945 percent	−15.8	−10.6	+13.5	+20.5	−7.7	−0.2	−13.8	−8.6

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

[2] A small amount of washery coal included with breakers.

[3] For purposes of historical comparison and statistical convenience, the mines of Sullivan County are grouped with the Pennsylvania anthracite region, although the product is classified as semianthracite according to the American Society for Testing Materials Tentative Standard.

The figures for breaker and washery product are not exactly equivalent to the fresh-mined and culm-bank coal because of the practice sometimes adopted of putting culm-bank coal through a breaker, either directly from the bank or after preliminary treatment in a washery. The tonnage of culm-bank coal prepared at the breakers is broken down by fields and shown in table 23.

Culm-bank coal.—The culm banks in the anthracite region have been a source of coal for many years. In the early days of anthracite mining, the smaller sizes of anthracite, especially Pea and under, were not used as they are today, and these sizes and larger pieces of refuse containing much good coal were piled in large banks throughout the region. In recent years, with the increased demand for the smaller sizes and more efficient preparation methods, the product of these banks is cleaned in the washery or breaker, and a prepared coal is obtained. In 1945 this source supplied 8,786,659 net tons of coal. Tables 19 and 20 give a detailed break-down of culm-bank product by regions and fields.

TABLE 19.—*Pennsylvania anthracite produced in 1945, classified as fresh-mined, culm-bank, and river coal and as breaker, washery, and dredge product, by regions, in net tons*

Region and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand-loaded				
Lehigh:						
Breakers [1]	692, 749	5, 545, 328	2, 145, 098	1, 756, 939		10, 140, 114
Washeries [1]			12, 191	329, 925		342, 116
Dredges					41, 409	41, 409
Total Lehigh	692, 749	5, 545, 328	2, 157, 289	2, 086, 864	41, 409	10, 523, 639
Schuylkill:						
Breakers	2, 343, 301	5, 363, 648	6, 132, 151	3, 483, 324		17, 322, 424
Washeries		6, 520	44, 264	1, 453, 583		1, 504, 367
Dredges					1, 163, 817	1, 163, 817
Total Schuylkill	2, 343, 301	5, 370, 168	6, 176, 415	4, 936, 907	1, 163, 817	19, 990, 608
Wyoming:						
Breakers [1]	10, 891, 905	9, 977, 114	1, 640, 888	993, 399		23, 503, 306
Washeries [1]				735, 041		735, 041
Total Wyoming	10, 891, 905	9, 977, 114	1, 640, 888	1, 728, 440		24, 238, 347
Total, excluding Sullivan County:						
Breakers [1]	13, 927, 955	20, 886, 090	9, 918, 137	6, 233, 662		50, 965, 844
Washeries [1]		6, 520	56, 455	2, 518, 549		2, 581, 524
Dredges					1, 205, 226	1, 205, 226
Total, excluding Sullivan County	13, 927, 955	20, 892, 610	9, 974, 592	8, 752, 211	1, 205, 226	54, 752, 594
Sullivan County:						
Breakers		65, 134	81, 733	2, 638		149, 505
Washeries				31, 810		31, 810
Total Sullivan County		65, 134	81, 733	34, 448		181, 315
Grand total	13, 927, 955	20, 957, 744	10, 056, 325	8, 786, 659	1, 205, 226	54, 933, 909

[1] A small quantity of washery coal included in breakers.

TABLE 20.—*Pennsylvania anthracite produced in 1945, classified as fresh-mined, culm-bank, and river coal, and as breaker, washery, and dredge product, by fields, in net tons*

Field and type of plant	From mines			From culm banks	From river dredging	Total
	Underground		Strip pits			
	Mechanically loaded	Hand-loaded				
Eastern Middle:						
Breakers [1]	692,749	2,614,786	998,834	698,876		5,005,245
Washeries [1]			12,191	329,925		342,116
Total Eastern Middle	692,749	2,614,786	1,011,025	1,028,801		5,347,361
Western Middle:						
Breakers	2,020,655	3,983,351	3,201,318	2,335,200		11,540,524
Washeries				130,789		130,789
Dredges					308,976	308,976
Total Western Middle	2,020,655	3,983,351	3,201,318	2,465,989	308,976	11,980,289
Southern:						
Breakers	322,646	4,310,839	4,077,097	2,206,187		10,916,769
Washeries		6,520	44,264	1,322,794		1,373,578
Dredges					896,250	896,250
Total Southern	322,646	4,317,359	4,121,361	3,528,981	896,250	13,186,597
Northern:						
Breakers [1]	10,891,905	9,977,114	1,640,888	993,399		23,503,306
Washeries [1]				735,041		735,041
Total Northern	10,891,905	9,977,114	1,640,888	1,728,440		24,238,347
Total, excluding Sullivan County:						
Breakers [1]	13,927,955	20,886,090	9,918,137	6,233,662		50,965,844
Washeries [1]		6,520	56,455	2,518,549		2,581,524
Dredges					1,205,226	1,205,226
Total, excluding Sullivan County	13,927,955	20,892,610	9,974,592	8,752,211	1,205,226	54,752,594
Sullivan County:						
Breakers		65,134	81,733	2,638		149,505
Washeries				31,810		31,810
Total Sullivan County		65,134	81,733	34,448		181,315
Grand total	13,927,955	20,957,744	10,056,325	8,786,659	1,205,226	54,933,909

[1] A small quantity of washery coal included in breakers.

TABLE 21.—*Pennsylvania anthracite shipped in 1945, by regions and sizes*

Size	Breaker shipments [1]						Washery shipments		Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total		Excluding Sullivan County	Including Sullivan County		
					Excluding Sullivan County	Including Sullivan County				
NET TONS										
Lump [2] and Broken	58,898	21,007	33,576		113,481	113,481				113,481
Egg	535,621	962,470	1,446,655		2,944,746	2,944,746				2,944,746
Stove	1,795,930	2,617,399	5,393,567	27,664	9,806,896	9,834,560	169,434	169,434		10,003,994
Chestnut	2,065,221	3,544,208	5,905,322	30,995	11,514,751	11,545,746	329,484	346,882		11,892,628
Pea	833,152	1,442,188	1,222,836	13,826	3,498,176	3,512,002	137,182	143,323	(3)	3,655,325
Total domestic	5,288,822	8,587,272	14,001,956	72,485	27,878,050	27,950,535	636,100	659,639		28,610,174
Buckwheat No. 1	1,266,684	2,508,111	2,597,998	14,178	6,372,793	6,386,971	275,828	282,384	[3] 11,816	6,681,171
Buckwheat No. 2 (Rice)	863,565	1,552,535	1,256,923	2,530	3,673,023	3,675,553	243,515	245,130	28,306	3,948,989
Buckwheat No. 3 (Barley)	920,284	2,327,347	1,252,231		4,499,862	4,499,862	484,558	484,558	236,655	5,221,075
Buckwheat No. 4	327,882	1,049,942	265,013		1,642,837	1,642,837	312,152	312,152	327,186	2,282,175
Other (including silt)	663,540	243,983	166,406	20,019	1,073,929	1,093,948	567,563	567,563	137,356	1,798,867
Total steam	4,041,955	7,681,918	5,538,571	36,727	17,262,444	17,299,171	1,883,616	1,891,787	741,319	19,932,277
Grand total	9,330,777	16,269,190	19,540,527	109,212	45,140,494	45,249,706	2,519,716	2,551,426	741,319	48,542,451
VALUE										
Lump [2] and Broken	$470,130	$171,649	$268,738		$910,517	$910,517				$910,517
Egg	4,337,850	7,870,455	11,735,796		23,944,101	23,944,101				23,944,101
Stove	14,570,850	21,409,157	43,513,157	$204,940	79,493,164	79,698,104	$1,299,829	$1,299,829		80,997,933
Chestnut	16,708,718	29,061,874	47,751,243	233,331	93,521,835	93,755,166	2,554,208	2,652,547		96,407,713
Pea	5,463,945	9,608,814	8,071,347	88,518	23,144,106	23,232,624	856,617	885,327	(3)	24,117,951
Total domestic	41,551,493	68,121,949	111,340,281	526,789	221,013,723	221,540,512	4,710,654	4,837,703		226,378,215
Buckwheat No. 1	6,035,158	12,028,400	12,441,428	57,824	30,504,986	30,562,810	1,211,934	1,230,675	[3] $55,304	31,848,789
Buckwheat No. 2 (Rice)	3,345,719	6,032,658	4,969,960	6,455	14,348,337	14,354,792	834,135	835,528	70,845	15,261,165
Buckwheat No. 3 (Barley)	2,458,549	6,067,476	3,411,108		11,937,133	11,937,133	1,198,902	1,198,902	430,233	13,566,268
Buckwheat No. 4	662,333	1,895,335	481,971		3,039,639	3,039,639	573,336	573,336	444,390	4,057,365
Other (including silt)	1,073,801	361,106	246,574	45,442	1,681,481	1,726,923	929,529	929,529	153,630	2,810,082
Total steam	13,575,560	26,384,975	21,551,041	109,721	61,511,576	61,621,297	4,747,836	4,767,970	1,154,402	67,543,669

See footnotes at end of table.

TABLE 21.—*Pennsylvania anthracite shipped in 1945, by region and sizes*—Continued

Size	Breaker shipments [1]						Washery shipments		Dredge shipments	Grand total
	Lehigh region	Schuylkill region	Wyoming region	Sullivan County	Total		Excluding Sullivan County	Including Sullivan County		
					Excluding Sullivan County	Including Sullivan County				
VALUE—continued										
Grand total	$55, 127, 053	$94, 506, 924	$132, 891, 322	$636, 510	$282, 525, 299	$283, 161, 809	$9, 458, 490	$9, 605, 673	$1, 154, 402	$293, 921, 884
AVERAGE VALUE PER TON										
Lump [2] and Broken	$7. 98	$8. 17	$8. 00		$8. 02	$8. 02				$8. 02
Egg	8. 10	8. 18	8. 11		8. 13	8. 13				8. 13
Stove	8. 11	8. 18	8. 07	$7. 41	8. 11	8. 10	$7. 67	$7. 67		8. 10
Chestnut	8. 09	8. 20	8. 09	7. 53	8. 12	8. 12	7. 75	7. 65		8. 11
Pea	6. 56	6. 66	6. 60	6. 40	6. 62	6. 62	6. 24	6. 18	(3)	6. 60
Total domestic	7. 86	7. 93	7. 95	7. 27	7. 93	7. 93	7. 41	7. 33		7. 91
Buckwheat No. 1	4. 76	4. 80	4. 79	4. 08	4. 79	4. 79	4. 39	4. 36	[3] $4. 68	4. 77
Buckwheat No. 2 (Rice)	3. 87	3. 89	3. 95	2. 55	3. 91	3. 91	3. 43	3. 41	2. 50	3. 86
Buckwheat No. 3 (Barley)	2. 67	2. 61	2. 72		2. 65	2. 65	2. 47	2. 47	1. 82	2. 60
Buckwheat No. 4	2. 02	1. 81	1. 82		1. 85	1. 85	1. 84	1. 84	1. 36	1. 78
Other (including silt)	1. 62	1. 48	1. 48	2. 27	1. 57	1. 58	1. 64	1. 64	1. 12	1. 56
Total steam	3. 36	3. 43	3. 89	2. 99	3. 56	3. 56	2. 52	2. 52	1. 56	3. 39
Grand total	5. 91	5. 81	6. 80	5. 83	6. 26	6. 26	3. 75	3. 76	1. 56	6. 05

[1] Figures of shipments from breakers include some culm-bank coal handled in the breakers.
[2] Quantity of Lump included is insignificant.
[3] A small quantity of Pea included in Buckwheat No. 1.

TABLE 22.—*Pennsylvania anthracite produced in 1945, by counties*

County	Total shipments		Sold to local trade		Used for power and heat		Total production	
	Net tons	Value [1]	Net tons	Value	Net tons	Value	Net tons	Value [1]
Berks, Lancaster, Lebanon, Northampton, and Synder [2]	29,828	$53,063	189,530	$288,263	23	$35	219,381	$341,361
Carbon	3,660,846	20,835,066	209,369	1,504,289	91,986	261,148	3,962,201	22,600,503
Columbia	890,244	5,857,403	68,821	371,638	54,642	103,398	1,013,707	6,332,439
Dauphin	368,549	1,277,127	233,395	427,981	2,012	4,829	603,956	1,709,937
Lackawanna	6,181,663	38,935,028	1,059,713	7,076,596	385,358	854,472	7,626,734	46,866,096
Luzerne	17,636,647	118,185,649	1,641,506	10,409,670	1,284,554	2,404,448	20,562,707	130,999,767
Northumberland	4,684,731	25,430,956	261,035	1,626,859	29,747	56,229	4,975,513	27,114,044
Schuylkill	14,833,009	82,141,680	569,167	3,689,225	254,072	653,971	15,656,248	86,484,876
Sullivan	140,922	783,693	39,793	234,799	600	1,750	181,315	1,020,242
Susquehanna and Wayne	116,012	422,219	1,535	10,039	14,600	42,912	132,147	475,170
Total	48,542,451	293,921,884	4,273,864	25,639,359	2,117,594	4,383,192	54,933,909	323,944,435

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.
[2] Counties producing dredge coal only.

TABLE 23.—*Culm-bank coal put through breakers, 1941–45, by fields, in net tons*

Year	Northern	Eastern Middle	Western Middle	Southern	Total
1941	113,000	57,000	519,000	387,000	1,076,000
1942	291,000	420,000	1,413,000	524,000	2,648,000
1943	[1 2] 630,000	1,088,000	2,102,000	1,208,000	[1] 5,028,000
1944	[2] 1,156,000	744,000	2,528,000	1,700,000	6,128,000
1945	[1 2] 996,000	[1] 699,000	2,335,000	2,206,000	[1] 6,236,000

[1] Includes some washery coal.
[2] A small quantity of culm-bank coal was put through breakers in Sullivan County.

Interregional variation in sizes.—The relative yield of domestic and steam sizes of anthracite in the three regions is greatly affected by geologic conditions, mining methods, and the quantity of culm-bank coal recovered.

In 1945, the breaker output of the Wyoming region consisted of 71.7 percent domestic and 28.3 percent steam sizes; of the Lehigh region, 56.7 percent domestic and 43.3 percent steam sizes; and of the Schuylkill region, 52.8 percent domestic and 47.2 percent steam sizes.

Table 21 shows shipments of anthracite, by regions and sizes. Table 24 shows percentages, by regions, of various sizes in relation to total breaker product.

Historical statistics.—Table 25 presents pertinent historical data on the Pennsylvania anthracite industry 1890–1945.

TABLE 24.—*Sizes of Pennsylvania anthracite shipped from breakers, 1943–45, by regions, in percent of total*

[Note that shipments of dredge and washery coal are not included]

Size	Percent of total shipments								
	Lehigh region			Schuylkill region			Wyoming region		
	1943	1944	1945	1943	1944	1945	1943	1944	1945
Lump [1] and Broken	0.7	0.5	0.6	0.5	0.1	0.1	0.2	0.5	0.2
Egg	6.1	6.0	5.8	5.7	6.2	5.9	8.5	8.3	7.4
Stove	19.6	19.2	19.3	17.1	17.0	16.1	27.6	26.9	27.6
Chestnut	22.0	22.1	22.1	21.0	21.8	21.8	28.1	29.1	30.2
Pea	9.5	9.3	8.9	9.7	9.3	8.9	7.6	6.9	6.3
Total domestic	57.9	57.1	56.7	54.0	54.4	52.8	72.0	71.7	71.7
Buckwheat No. 1	14.7	14.3	13.6	15.8	15.4	15.4	12.8	13.3	13.3
Buckwheat No. 2 (Rice)	9.3	9.6	9.2	10.1	10.0	9.5	6.6	6.8	6.4
Buckwheat No. 3 (Barley)	11.4	11.1	9.9	13.5	13.4	14.3	6.6	6.4	6.4
Buckwheat No. 4	2.5	2.5	3.5	5.6	5.7	6.5	1.3	1.3	1.4
Other (including silt)	4.2	5.4	7.1	1.0	1.1	1.5	0.7	0.5	0.8
Total steam	42.1	42.9	43.3	46.0	45.6	47.2	28.0	28.3	28.3

Size	Sullivan County			Total					
				Excluding Sullivan County			Including Sullivan County		
Lump [1] and Broken	------	------	------	0.4	0.4	0.3	0.4	0.3	0.3
Egg	------	------	------	7.1	7.1	6.5	7.1	7.1	6.5
Stove	12.4	14.5	25.3	22.4	21.9	21.7	22.4	21.9	21.7
Chestnut	20.6	26.4	28.4	24.5	25.2	25.5	24.5	25.2	25.5
Pea	22.3	22.1	12.7	8.7	8.2	7.8	8.7	8.3	7.8
Total domestic	55.3	63.0	66.4	63.1	62.8	61.8	63.1	62.8	61.8
Buckwheat No. 1	10.8	12.5	13.0	14.2	14.3	14.1	14.2	14.2	14.1
Buckwheat No. 2 (Rice)	------	1.6	2.3	8.3	8.5	8.1	8.3	8.5	8.1
Buckwheat No. 3 (Barley)	------	------	------	9.9	9.7	10.0	9.9	9.7	9.9
Buckwheat No. 4	------	22.9	------	3.0	3.0	3.6	3.0	3.1	3.6
Other (including silt)	33.9	------	18.3	1.5	1.7	2.4	1.5	1.7	2.5
Total steam	44.7	37.0	33.6	36.9	37.2	38.2	36.9	37.2	38.2

[1] Quantity of Lump included is insignificant.

TABLE 25.—*Statistical trends in the Pennsylvania anthracite industry, 1890–1945*

Year	Production (net tons)	Value of total production	Average value per net ton	Exports (net tons) [1]	Imports (net tons) [1]	Consumption (calculated) (net tons) [2]	Average number of employees	Average number of days worked	Average tons per man per day	Average tons per man per year	Quantity cut by machines (net tons) [3]	Quantity produced by stripping (net tons) [4]	Quantity loaded mechanically underground (net tons) [5]
1890	46, 468, 641	$66, 383, 772	$1. 43	889, 655	16, 962	45, 596, 000	126, 000	200	1. 85	369	----------	----------	----------
1891	50, 665, 431	73, 944, 735	1. 46	964, 601	42, 120	49, 743, 000	126, 350	203	1. 98	401	----------	----------	----------
1892	52, 472, 504	82, 442, 000	1. 57	953, 836	72, 865	51, 592, 000	129, 050	198	2. 06	407	----------	----------	----------
1893	53, 967, 543	85, 687, 078	1. 59	1, 493, 281	60, 220	52, 534, 000	132, 944	197	2. 06	406	----------	----------	----------
1894	51, 921, 121	78, 488, 063	1. 51	1, 613, 500	100, 876	50, 408, 000	131, 603	190	2. 08	395	----------	----------	----------
1895	57, 999, 337	82, 019, 272	1. 41	1, 647, 195	158, 297	56, 510, 000	142, 917	196	2. 07	406	----------	----------	----------
1896	54, 346, 081	81, 748, 651	1. 50	1, 512, 000	113, 892	52, 948, 000	148, 991	174	2. 10	365	----------	----------	----------
1897	52, 611, 681	79, 301, 954	1. 51	1, 454, 620	27, 478	51, 185, 000	149, 884	150	2. 34	351	----------	----------	----------
1898	53, 382, 645	75, 414, 537	1. 41	1, 513, 062	3, 527	51, 873, 000	145, 504	152	2. 41	367	----------	----------	----------
1899	60, 418, 005	88, 142, 130	1. 46	1, 912, 732	68	58, 505, 000	139, 608	173	2. 50	433	----------	----------	----------
1900	57, 367, 915	85, 757, 851	1. 49	1, 853, 163	132	55, 515, 000	144, 206	166	2. 40	398	----------	----------	----------
1901	67, 471, 667	112, 504, 020	1. 67	2, 232, 504	320	65, 239, 000	145, 309	196	2. 37	464	----------	----------	----------
1902	41, 373, 595	76, 173, 586	1. 84	1, 016, 934	190, 636	40, 547, 000	148, 141	116	2. 40	279	----------	----------	----------
1903	74, 607, 068	152, 036, 448	2. 04	2, 249, 920	196, 837	72, 554, 000	150, 483	206	2. 41	496	----------	----------	----------
1904	73, 156, 709	138, 974, 020	1. 90	2, 495, 799	81, 232	70, 742, 000	155, 861	200	2. 35	469	----------	----------	----------
1905	77, 659, 850	141, 879, 000	1. 83	2, 497, 581	38, 350	75, 201, 000	165, 406	215	2. 18	470	----------	----------	----------
1906	71, 282, 411	131, 917, 694	1. 85	2, 483, 005	36, 236	68, 836, 000	162, 355	195	2. 25	439	----------	----------	----------
1907	85, 604, 312	163, 584, 056	1. 91	3, 021, 841	11, 085	82, 594, 000	167, 234	220	2. 33	512	----------	----------	----------
1908	83, 268, 754	158, 178, 849	1. 90	3, 082, 641	18, 462	80, 205, 000	174, 174	200	2. 39	478	----------	----------	----------
1909	81, 070, 359	149, 181, 587	1. 84	3, 183, 840	3, 574	77, 890, 000	[6] 171, 195	205	(7)	(7)	----------	----------	----------
1910	84, 485, 236	160, 275, 302	1. 90	3, 384, 222	9, 180	81, 110, 000	169, 497	229	2. 17	498	----------	----------	----------
1911	90, 464, 067	175, 189, 392	1. 94	3, 980, 479	2, 759	86, 486, 000	172, 585	246	2. 13	524	69, 907	----------	----------
1912	84, 361, 598	177, 622, 626	2. 11	4, 131, 444	1, 870	80, 232, 000	174, 030	231	2. 10	485	246, 216	----------	----------
1913	91, 524, 922	195, 181, 127	2. 13	4, 652, 912	1, 004	85, 474, 000	175, 745	257	2. 02	520	555, 776	----------	----------
1914	90, 821, 507	188, 181, 399	2. 07	4, 289, 873	17, 696	84, 041, 000	179, 679	245	2. 06	505	916, 596	----------	----------
1915	88, 995, 061	184, 653, 498	2. 07	3, 965, 255	814	88, 144, 000	176, 552	230	2. 19	504	1, 307, 756	1, 121, 603	----------
1916	87, 578, 493	202, 009, 561	2. 31	4, 665, 530	6, 000	87, 118, 000	159, 869	253	2. 16	548	1, 839, 506	1, 987, 800	----------
1917	99, 611, 811	283, 650, 723	2. 85	6, 007, 306	13, 000	94, 068, 000	154, 174	285	2. 27	646	1, 955, 223	2, 301, 588	----------
1918	98, 826, 084	336, 480, 347	3. 40	4, 967, 808	37, 272	92, 775, 000	147, 121	293	2. 29	672	1, 857, 514	2, 360, 183	----------
1919	88, 092, 201	364, 926, 950	4. 14	4, 976, 598	82, 818	81, 518, 000	154, 571	266	2. 14	570	1, 575, 205	2, 006, 879	----------
1920	89, 598, 249	434, 252, 198	4. 85	5, 403, 749	31, 748	85, 786, 000	145, 074	271	2. 28	618	938, 073	2, 054, 441	----------

See footnotes at end of table.

TABLE 25.—*Statistical trends in the Pennsylvania anthracite industry, 1890–1945*—Continued

Year	Production (net tons)	Value of total production	Average vlaue per net ton	Exports valuezper	imports (net tons) [2]	Consumption (calculated) (net tons) [2]	Average number of employees	Average number of days worked	Average tons per man per day	Average tons per man per year	Quantity cut by machines (net tons) [3]	Quantity produced by stripping (net tons) [4]	Quantity loaded mechanically underground (net tons) [5]
1921	90, 473, 451	$452, 304, 903	$5. 00	4, 677, 368	8, 894	81, 950, 000	159, 499	271	2. 09	567	979, 145	2, 027, 790	----------
1922	54, 683, 022	273, 700, 125	5. 01	2, 649, 457	233, 528	56, 799, 000	156, 849	151	2. 31	349	502, 793	949, 745	----------
1923	93, 339, 009	506, 786, 768	5. 43	5, 090, 138	300, 360	86, 914, 000	157, 743	268	2. 21	592	1, 208, 542	2, 263, 098	----------
1924	87, 926, 862	477, 230, 852	5. 43	4, 017, 785	117, 951	80, 717, 000	160, 009	274	2. 00	550	1, 423, 884	1, 865, 677	----------
1925	61, 817, 149	327, 664, 512	5. 30	3, 179, 006	382, 894	64, 061, 000	160, 312	182	2. 12	386	941, 189	1, 578, 478	----------
1926	84, 437, 452	474, 164, 252	5. 62	4, 029, 683	813, 956	77, 221, 000	165, 386	244	2. 09	511	931, 650	2, 401, 356	----------
1927	80, 095, 564	420, 941, 726	5. 26	3, 325, 507	119, 030	74, 672, 000	165, 259	225	2. 15	485	1, 171, 888	2, 153, 156	[6] 2, 223, 281
1928	75, 348, 069	393, 637, 690	5. 22	3, 336, 272	384, 707	73, 650, 000	160, 681	217	2. 17	469	1, 289, 809	2, 422, 924	[6] 2, 351, 074
1929	73, 828, 195	385, 642, 751	5. 22	3, 406, 369	487, 172	71, 457, 000	151, 501	225	2. 16	487	1, 159, 910	1, 911, 766	3, 470, 158
1930	69, 384, 837	354, 574, 191	5. 11	2, 551, 659	674, 812	67, 628, 000	150, 804	208	2. 21	460	1, 410, 123	2, 536, 288	4, 467, 750
1931	59, 645, 652	296, 354, 586	4. 97	1, 778, 308	637, 951	58, 408. 000	139, 431	181	2. 37	428	1, 587, 265	3, 813, 237	4, 384, 780
1932	49, 855, 221	222, 375, 129	4. 46	1, 303, 355	607, 097	50, 500, 000	121, 243	162	2. 54	411	1, 674, 223	3, 980, 973	5, 433, 340
1933	49, 541, 344	206, 718, 405	4. 17	1, 034, 562	456, 252	49, 600, 000	104, 633	182	2. 60	473	1, 648, 249	4, 932, 069	6, 557, 267
1934	57, 168, 291	244, 152, 245	4. 27	1, 297, 610	478, 118	55, 500, 000	109, 050	207	2. 53	524	1, 981, 088	5, 798, 138	9, 284, 486
1935	52, 158, 783	210, 130, 565	4. 03	1, 608, 549	571, 439	51, 100, 000	103, 269	189	2. 68	505	1, 848, 095	5, 187, 072	9, 279, 057
1936	54, 579, 535	227, 003, 538	4. 16	1, 678, 024	614, 639	53, 200, 000	102, 081	192	2. 79	535	2, 162, 744	6, 203, 267	10, 827, 946
1937	51, 856, 433	197, 598, 849	3. 81	1, 914, 173	395, 737	50, 400, 000	99, 085	189	2. 77	523	1, 984, 512	5, 696, 018	10, 683, 837
1938	46, 099, 027	180, 600, 167	3. 92	1, 908, 911	362, 895	45, 200, 000	96, 417	171	2. 79	478	1, 588, 407	5, 095, 341	10, 151, 669
1939	51, 487, 377	187, 175, 324	3. 64	2, 590, 000	298, 153	49, 700, 000	93, 138	183	3. 02	553	1, 881, 884	5, 486, 479	11, 773, 833
1940	51, 484, 640	205, 489, 814	3. 99	2, 667, 632	135, 436	49, 000, 000	91, 313	186	3. 02	562	1, 816, 483	6, 352, 700	12, 326, 000
1941	[8] 56, 368, 267	240, 275, 126	4. 26	3, 380, 189	74, 669	52, 700, 000	88, 054	203	[9] 3. 04	617	1, 855, 422	7, 316, 574	13, 441, 987
1942	[8] 60, 327, 729	271, 673, 380	4. 50	4, 438, 588	140, 115	56, 500, 000	82, 121	239	[9] 2. 95	705	2, 285, 640	9, 070, 933	14, 741, 459
1943	[8] 60, 643, 620	306, 816, 018	5. 06	4, 138, 680	166, 020	57, 100, 000	79, 153	270	[9] 2. 78	751	1, 624, 883	8, 989, 387	14, 745, 793
1944	[8] 63, 701, 363	354, 582, 884	5. 57	4, 185, 933	11, 847	59, 400, 000	77, 591	292	[9] 2. 79	815	1, 336, 082	10, 953, 030	14, 975, 146
1945	[8] 54, 933, 909	323, 944, 435	5. 90	3, 691, 247	149	51, 600, 000	72, 842	269	[9] 2. 79	751	1, 210, 171	10, 056, 325	13, 927, 955

[1] U. S. Department of Commerce.
[2] Prior to 1913 the figures of consumption take no account of producers' stocks, there being no data available for this item.
[3] Data first collected in 1911.
[4] Data first collected in 1915.
[5] Data first collected in 1929.
[6] As reported by the Commonwealth of Pennsylvania, Department of Mines.
[7] Data not available.
[8] Includes some "bootleg" coal purchased by legitimate operators and prepared at their breakers.
[9] Output per man per day calculated on legitimate tonnages only; "bootleg" purchases excluded.

AVERAGE VALUE AND SALES REALIZATION

The average realization figures in this study represent value at the breaker, washery, or dredge reported by the operating companies. The company is requested to "estimate value of the product not sold" and to "exclude selling expenses" in making its report. From this it will be seen that when a producing concern sells its output to a separately organized sales company the value reported will exclude the margin of the sales company and may therefore be somewhat less than the circular price at which the coal is placed on the general market. This fact should be borne in mind in considering the variations in value among different regions for the same sizes of coal, as shown in the tables.

The average sales realization per net ton on breaker shipments was $6.26 in 1945, compared with $5.91 in 1944—a 6-percent increase. (See table 26.)

With the inclusion of local sales, colliery fuel, washery coal, and dredge coal the average value per net ton of the total 1945 production is $5.90, compared with $5.57 in 1944. (See table 27.)

TABLE 26.—*Average sales realization per net ton on Pennsylvania anthracite shipments from breakers, 1943–45, by regions and sizes*

[Value does not include margins of separately incorporated sales companies]

Size	Lehigh region			Schuylkill region			Wyoming region		
	1943	1944	1945	1943	1944	1945	1943	1944	1945
Lump [1] and Broken	$6.78	$7.40	$7.98	$6.83	$7.67	$8.17	$6.69	$7.46	$8.00
Egg	7.01	7.58	8.10	6.97	7.58	8.18	6.93	7.54	8.11
Stove	6.99	7.61	8.11	6.99	7.62	8.18	6.95	7.54	8.07
Chestnut	7.00	7.61	8.09	6.99	7.64	8.20	6.95	7.54	8.09
Pea	5.48	6.16	6.56	5.48	6.16	6.66	5.48	6.02	6.60
Total domestic	6.75	7.37	7.86	6.71	7.37	7.93	6.79	7.39	7.95
Buckwheat No. 1	4.00	4.54	4.76	3.96	4.52	4.80	4.04	4.52	4.79
Buckwheat No. 2 (Rice)	3.13	3.65	3.87	3.05	3.51	3.89	3.21	3.65	3.95
Buckwheat No. 3 (Barley)	2.26	2.55	2.67	2.19	2.45	2.61	2.35	2.65	2.72
Buckwheat No. 4	1.69	1.94	2.02	1.50	1.77	1.81	1.61	1.87	1.82
Other (including silt)	1.26	1.43	1.62	.92	1.23	1.48	1.00	1.45	1.48
Total steam	2.93	3.29	3.36	2.87	3.27	3 43	3.25	3.71	3.89
Total all sizes	5.14	5.62	5.91	4.95	5.50	5.81	5.80	6.35	6.80

Size	Sullivan County			Total— Excluding Sullivan County			Total— Including Sullivan County		
Lump [1] and Broken	------	------	------	$6.77	$7.47	$8.02	$6.77	$7.47	$8.02
Egg	------	------	------	6.96	7.56	8.13	6.96	7.56	8.13
Stove	$5.63	$6.91	$7.41	6.97	7.58	8.11	6.96	7.57	8.10
Chestnut	5.51	6.83	7.53	6.97	7.58	8.12	6.97	7.58	8.12
Pea	4.85	6.00	6.40	5.48	6.11	6.62	5.48	6.11	6.62
Total domestic	5.27	6.56	7.27	6.76	7.38	7.93	6.76	7.38	7.93
Buckwheat No. 1	3.90	4.01	4.08	4.00	4.52	4.79	4.00	4.52	4.79
Buckwheat No. 2 (Rice)	------	2.03	2.55	3.12	3.59	3.91	3.12	3.59	3.91
Buckwheat No. 3 (Barley)	------	------	------	2.25	2.53	2.65	2.25	2.53	2.65
Buckwheat No. 4	------	2.05	------	1.55	1.82	1.85	1.55	1.82	1.85
Other (including silt)	1.89	------	2.27	1.13	1.39	1.57	1.16	1.39	1.58
Total steam	2.37	2.71	2.99	3.02	3.42	3.56	3.02	3.42	3.56
Total all sizes	3.98	5.13	5.83	5.38	5.91	6.26	5.38	5.91	6.26

[1] Quantity of Lump included is insignificant.

TABLE 27.—*Average value per ton of Pennsylvania anthracite shipments, local sales, colliery fuel, and total production, 1944–45, by regions* [1]

[Note that values in this table include washery and dredge coal]

Region	1944				1945			
	Shipments	Local sales	Colliery fuel	Total production	Shipments	Local sales	Colliery fuel	Total production
Lehigh	$5.56	$6.54	$2.85	$5.51	$5.84	$7.06	$3.15	$5.83
Schuylkill	5.14	4.78	1.99	5.08	5.52	4.74	2.14	5.42
Wyoming	6.28	5.90	1.69	5.99	6.65	6.41	1.85	6.33
Total, excluding Sullivan County	5.71	5.65	1.91	5.57	6.06	6.00	2.07	5.90
Sullivan County	5.13	5.92		5.25	5.56	5.90	2.92	5.63
Grand total	5.71	5.65	1.91	5.57	6.05	6.00	2.07	5.90

[1] Value given for shipments is value at which coal left possession of producing company and does not include margins of separately incorporated sales companies.

LABOR STATISTICS

A labor shortage of several thousand men characterized the Pennsylvania anthracite industry in 1945, when the average number of men working was 72,842—a 6-percent decrease from the 77,591 men employed in 1944. With cessation of hostilities, the labor outlook improved, and it is expected that in 1946 the average number of men employed in the industry will increase.

The employment statistics in this chapter do not include workers in "bootleg" coal mining conducted in the Southern and Western Middle fields of the anthracite regions. According to the Anthracite Committee, 10,762 men were working 3,006 "bootleg" holes in March 1941, and in March 1946 a comparable survey revealed 1,939 men employed in 526 holes. Although these workers are not included in the employment data, the coal produced by some of them was purchased (260,342 net tons) by the recognized industry for preparation and shipment to market, and coal so purchased is included in the production tables of this chapter. Complete employment data for the "bootleg" holes from which this coal was produced are not available. In calculating the output per man per day, therefore, the tons of "bootleg" coal purchased by the recognized industry were deducted from the total tonnage reported by the operators, and the resulting legitimate production was then used to calculate the output per man per day. It is true that part of the time of the men employed at the preparation plants of the recognized companies was used to prepare this purchased coal for market; however, on a per-ton basis this time is insignificant, and its omission will not detract materially from the validity of the result obtained.

See tables 28 and 29 for details on labor statistics.

TABLE 28.—*Men employed and days worked at operations producing Pennsylvania anthracite in 1945, by regions*[1]

[Includes operations of strip contractors]

Region	Average number of men employed								Average number of days plant operated	Man-days of labor	Average tons per man per day
	Underground			Surface				Grand total			
	Miners and their laborers	Other	Total underground	In strip pits	In preparation plant	Other	Total surface				
Lehigh:											
Breaker	5,503	3,085	8,588	1,147	1,016	2,722	4,885	13,473	255	3,437,431	2.95
Washery [2]				5	93	95	193	193	262	50,614	6.76
Dredge					5	12	17	17	154	2,610	15.87
Total Lehigh	5,503	3,085	8,588	1,152	1,114	2,829	5,095	13,683	255	3,490,655	3.01
Schuylkill:											
Breaker	6,800	4,912	11,712	3,333	1,867	3,892	9,092	20,804	261	5,431,195	[3] 3.14
Washery [2]					116	563	679	679	219	148,736	[3] 10.11
Dredge					142	253	395	395	239	94,462	12.32
Total Schuylkill	6,800	4,912	11,712	3,333	2,125	4,708	10,166	21,878	259	5,674,393	3.48
Wyoming:											
Breaker	17,822	9,792	27,614	794	2,082	6,370	9,246	36,860	281	10,364,204	2.27
Washery [2]				4	59	155	218	218	226	49,293	14.91
Total Wyoming	17,822	9,792	27,614	798	2,141	6,525	9,464	37,078	281	10,413,497	2.33
Total, excluding Sullivan County:											
Breaker	30,125	17,789	47,914	5,274	4,965	12,984	23,223	71,137	270	19,232,830	[3] 2.64
Washery [2]				9	268	813	1,090	1,090	228	248,643	[3] 10.38
Dredge					147	265	412	412	236	97,072	12.42
Total, excluding Sullivan County	30,125	17,789	47,914	5,283	5,380	14,062	24,725	72,639	270	19,578,545	[3] 2.78
Sullivan County	67	19	86	31	69	17	117	203	247	50,097	3.62
Grand total	30,192	17,808	48,000	5,314	5,449	14,079	24,842	72,842	269	19,628,642	[3] 2.79

[1] Men employed in "bootleg" operations excluded.
[2] Represents washeries for which both production and employment were separately reported.
[3] Output per man per day calculated on legitimate tonnages only: "bootleg" purchases excluded.

TABLE 29.—*Men employed at operations producing Pennsylvania anthracite, 1944–45, by counties*

[Includes operations of strip contractors]

County	1944	1945	County	1944	1945
Berks, Lancaster, Lebanon, Northampton, and Snyder [1]	107	104	Northumberland	6,383	5,572
Carbon	5,036	4,907	Schuylkill	17,968	16,910
Columbia	1,825	1,897	Sullivan	186	203
Dauphin	285	327	Susquehanna and Wayne	41	57
Lackawanna	11,783	11,358	Total	77,591	72,842
Luzerne	33,977	31,507			

[1] Counties producing dredge coal only.

EQUIPMENT AND METHODS OF MINING

Mechanical loading.—The quantity of anthracite loaded mechanically underground decreased 7 percent in 1945 from 1944, while hand-loaded tonnage declined 22 percent. Details are shown in tables 30 to 32.

Figure 2 illustrates graphically the trend of underground mechanical and hand loading and of stripping in the Pennsylvania anthracite regions, 1928–45.

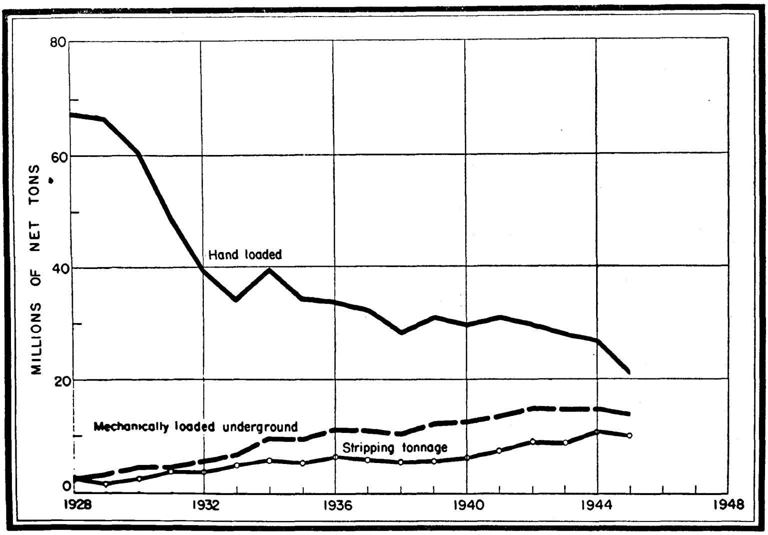

FIGURE 2.—Trend of mechanical loading, hand loading, and stripping of Pennsylvania anthracite 1928–45.

TABLE 30.—*Pennsylvania anthracite handled by mobile loaders and scrapers and by all types of conveyors in 1945, by fields, in net tons*

Field	Scraper loaders	Pit-car loaders	Hand-loaded face conveyors, all types [1]	Total mechanically loaded underground
Northern	2,019,630	272,553	8,599,722	10,891,905
Eastern Middle	128,439	21,040	543,270	692,749
Western Middle	539,522	114,786	1,366,347	2,020,655
Southern	205,872	7,800	108,974	322,646
Total	2,893,463	416,179	10,618,313	13,927,955

[1] Shaker chutes, etc., including those equipped with duckbills.

TABLE 31.—*Pennsylvania anthracite loaded mechanically underground, 1941–45*

Year	Scrapers [1]		Conveyors and pit-car loaders [2]		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons handled	Number of units	Net tons handled
1941	505	2, 673, 983	2, 432	10, 768, 004	2, 937	13, 441, 987
1942	524	2, 871, 926	2, 491	11, 869, 533	3, 015	14, 741, 459
1943	515	2, 807, 289	2, 701	11, 938, 504	3, 216	14, 745, 793
1944	503	2, 881, 661	2, 807	12, 093, 485	3, 310	14, 975, 146
1945	568	2, 893, 463	3, 006	11, 034, 492	3, 574	13, 927, 955

[1] Includes mobile loaders.
[2] Includes duckbills and other self-loading conveyors.

TABLE 32.—*Relative growth of mechanical loading, hand loading, and stripping in Pennsylvania anthracite mines, 1941–45*

[Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors]

Year	Net tons			Index numbers: 1927=100		
	Mechanical loading underground	Stripping	Hand loading	Mechanical loading underground	Stripping	Hand loading
1941	13, 441, 987	7, 316, 574	30, [illegible]35, 277	605	340	43
1942	14, 741, 459	9, 070, 933	30, 495, 240	663	421	43
1943	14, 745, 793	8, 989, 387	27, 990, 005	663	417	39
1944	14, 975, 146	10, 953, 030	26, 800, 270	674	509	38
1945	13, 927, 955	10, 056, 325	20, 957, 744	626	467	29

Strip-pit operations.—The heavy demand for anthracite throughout the war caused a rapid expansion of strip-pit activities, and the tonnage obtained by this method of mining increased from 14 percent of the total fresh-mined output in 1941 to 22 percent in 1945. As the output per man per day from strip mines is much larger than that in underground mines, production from this source alleviated considerably the shortage of anthracite occasioned by the scarcity of other space heating fuels. Much difficulty was experienced by the strip-pit operators in obtaining equipment, such as draglines, power shovels, trucks, and other supplies used in open-pit operations. It is expected that this condition will improve the latter part of 1946, and output from strip pits in that year should be considerably greater than production from this source in 1945. Details on strip-pit operations are given in table 33.

Figure 3 illustrates graphically the production of anthracite from strip pits, by regions, 1928–45.

Cutting machines.—The quantity of anthracite cut by machines declined 9 percent in 1945 from 1944. Details are shown in table 34.

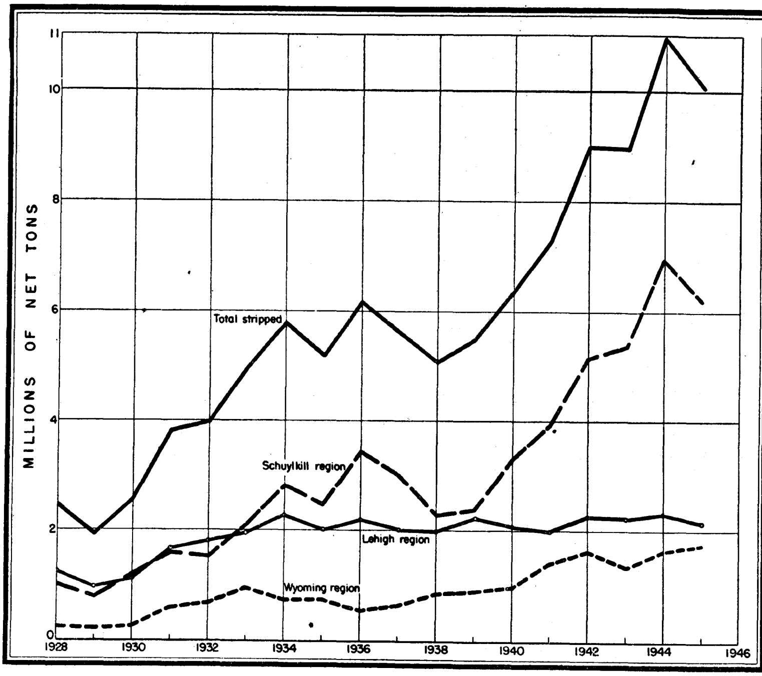

FIGURE 3.—Pennsylvania anthracite mined from strip pits, 1928–45, by regions.

TABLE 33.—*Relative growth of Pennsylvania anthracite mined from strip pits, 1915, 1920, 1925, 1930, and 1942–45*

	Net tons mined by stripping	Percent of fresh-mined total that was stripped	Number of men employed	Average number of days worked
1915	1,121,603	(1)	(1)	(1)
1920	2,054,441	2.5	(1)	(1)
1925	1,578,478	2.7	(1)	(1)
1930	2,536,288	3.7	(1)	(1)
1942	9,070,933	16.7	4,526	211
1943	8,989,387	17.4	5,084	229
1944	10,953,030	20.8	5,595	246
1945:				
Lehigh region	2,157,289	25.7	1,152	221
Schuylkill region	6,176,415	44.5	3,333	242
Wyoming region	1,640,888	7.3	798	244
Total, excluding Sullivan County	9,974,592	22.3	5,283	238
Sullivan County	81,733	55.7	31	205
Grand total, 1945	10,056,325	22.4	5,314	238

[1] Data not available.

TABLE 34.—*Pennsylvania anthracite cut by machines, 1944–45, by regions*

Region	1944			1945		
	Cutting machines		Net tons cut by machines	Cutting machines		Net tons cut by machines
	Permissible	All other types		Permissible	All other types	
Lehigh						
Schuylkill						
Wyoming	141	53	1,336,082	189	36	1,210,171
Total, excluding Sullivan County	141	53	1,336,082	189	36	1,210,171
Sullivan County						
Grand total	141	53	1,336,082	189	36	1,210,171

Dredge coal.—During the war period coal recovered from the streams draining the Pennsylvania anthracite regions played an important part in alleviating shortages of industrial coal in the markets adjacent to the anthracite fields. The dredging industry reached a peak in 1941 when 1,517,563 net tons of anthracite were taken from the river and creek beds; in 1945 river coal totaled 1,205,226 tons. For details, see table 35.

TABLE 35.—*Pennsylvania anthracite produced by dredges in 1945, by rivers*

River (including tributaries)	Net tons	Value	
		Total	Average
Lehigh	41,409	$70,439	$1.70
Schuylkill	366,161	529,071	1.44
Susquehanna	797,656	1,324,638	1.66
	1,205,226	1,924,148	1.60

FOREIGN TRADE

The demand for anthracite in Canada and other foreign countries in 1945 far exceeded the supply, and exports from the United States would have been much greater had more coal been available in this country. Exports of anthracite in 1945 totaled 3,691,247 net tons, and of this total 3,393,131 tons (92 percent) were destined to Canada. (See tables 36 and 37.)

Canadian market.—Coal and lignite production in Canada in 1945 decreased 3 percent from 1944, and coke production also declined approximately 3 percent. Imports of anthracite decreased 23 percent from 1944, but imports of bituminous and subbituminous coal declined only 14 percent. Coal available for consumption in 1945 was 11 percent less than in 1944. See table 38 for coal and coke statistics in Canada.

TABLE 36.—*Anthracite imported for consumption in the United States, 1944–45. by countries and customs districts, in net tons*

Country	1944	1945	Customs district	1944	1945
Canada	9	10	Maine and New Hampshire	11,838	
Spain		4	New York		135
United Kingdom	11,838	135	Philadelphia		4
			Vermont	9	10
	11,847	149		11,847	149

TABLE 37.—*Anthracite exported from the United States, 1944–45, by countries and customs districts, in net tons*

County	1944	1945
North America:		
Bermuda	1,267	55
Canada	4,144,297	3,393,131
Central America:		
British Honduras	3	
Guatemala	6	
Mexico	155	158
Newfoundland and Labrador	1,325	6,031
West Indies:		
British	151	16
Cuba	32,089	70,171
Curaçao (N. W. I.)	100	1
Other North America	8	85
South America:		
Bolivia		560
Brazil	4,957	4,480
Other South America	1,325	263
Europe:		
Belgium and Luxembourg		134,769
France		33,685
Portugal	187	9,287
Sweden		12,627
Switzerland		25,926
United Kingdom	59	
Other Europe		2
Africa	4	
	4,185,933	3,691,247

Customs district	1944	1945
North Atlantic:		
Connecticut		263
Maine and New Hampshire	26,629	27,678
Massachusetts	3	4
New York	17,181	4,809
Philadelphia	34,317	247,984
South Atlantic:		
Maryland	2,818	18,012
Virginia	3,512	
Gulf coast:		
Florida	45	94
Galveston		26,993
Mobile	75	
New Orleans	1,152	672
Mexican border:		
Arizona	43	9
El Paso	1	52
Laredo	100	38
Pacific coast:		
San Diego	11	4
Washington		90
Northern border:		
Buffalo	2,141,160	1,733,570
Dakota	1,671	1,857
Duluth and Superior	4,690	4,420
Michigan	981	804
Ohio	18,261	5,985
Rochester	287,320	247,156
St. Lawrence	1,634,425	1,369,191
Vermont	11,538	1,562
	4,185,933	3,691,247

TABLE 38.—*Coal and coke industry and foreign trade of Canada, 1944–45* [1]

[Thousands of net tons]

	Coal								Coke from coal	
	Anthracite		Bituminous and subbituminous		Lignite [2]		Total			
	1944	1945	1944	1945	1944	1945	1944	1945	1944	1945
Production			15,654	14,924	1,373	1,533	17,027	16,457	4,002	3,862
Imports	4,413	3,411	24,514	21,177	(3)	(3)	28,927	24,588	813	1,251
Exports			999	824	11	17	1,010	841	43	39
Available for consumption	4,413	3,411	39,169	35,277	1,362	1,516	44,944	40,204	4,772	5,074

[1] Monthly Coal and Coke Statistics for Canada, December 1945. Data for 1945 are preliminary.
[2] Beginning January 1945 the Canadian coals were reclassified according to American Society for Testing Materials Tentative Standard. As a result, all lignite except that produced in Saskatchewan and Manitoba was reclassified as bituminous or subbituminous.
[3] Less than 1,000 tons.

WORLD PRODUCTION

Data on world production of anthracite are incomplete because of unsettled conditions throughout the world in 1945. Available data for 1938–45 are shown in table 39.

TABLE 39.—*World production of anthracite, 1938–45, in metric tons*

[Compiled by B. B. Waldbauer]

Country	1938	1939	1940	1941	1942	1943	1944	1945
Belgium	6,874,520	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Bulgaria	4,000	6,038	8,000	(1)	(1)	(1)	(1)	(1)
China	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Eire	92,157	90,455	74,170	104,871	116,290	123,387	130,198	(1)
France	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Germany	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Indochina	2,289,832	2,534,000	2,400,000	(1)	(1)	1,293,200	(1)	(1)
Italy	132,197	107,255	162,140	158,339	163,565	(1)	(1)	53,446
Japan [3]	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Korea (Chosen)	1,696,061	2,064,000	(1)	(1)	(1)	(1)	(1)	(1)
Morocco, French	123,200	115,600	143,500	139,874	118,102	102,293	134,300	[4] 178,900
Peru	1,500	3,514	4,500	4,600	5,000	22,716	14,545	[4] 28,000
Portugal	281,740	294,081	286,854	436,324	404,144	368,321	389,638	436,117
Rumania	3,266	(1)	13,724	13,533	5,125	8,071	2,590	[4] 5,000
Spain	440,253	563,963	1,095,875	1,148,332	1,242,932	1,151,762	1,516,035	1,621,169
Switzerland	3,000	2,500	[4] 7,000	42,385	108,096	104,150	51,232	(1)
U. S. S. R.:								
Asiatic	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
European	(2)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
United Kingdom	6,378,904	(1)	(1)	(1)	(1)	(1)	(1)	(1)
United States (Pennsylvania)	41,820,115	46,708,319	46,705,836	51,136,164	54,728,109	55,014,679	57,788,602	49,834,944
World total	108,800,115	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Total, exclusive of United States	66,980,000	(1)	(1)	(1)	(1)	(1)	(1)	(1)

1 Data not available.
2 Estimate included in total.
3 Anthracite output of Japan said to average about 225,000 tons a year. Production figures not available.
4 Estimate.

COKE AND BYPRODUCTS

By J. A. De Carlo, J. A. Corgan, and Maxine M. Otero

SUMMARY OUTLINE

SUMMARY

The extraordinary activity in the coke industry in the United States during the period of World War II subsided markedly following the surrender of Japan in August 1945, and total output of byproduct and beehive coke for the year declined 9 percent from the record set in 1944. Production from byproduct ovens amounted to 62,094,288 net tons and from beehive ovens 5,213,893 tons, reductions of 7 percent and 25 percent, respectively, from the 1944 figures. When measured by peak 1944 wartime production output showed a severe decline, but when compared with former peacetime years it was substantially higher. The decline in 1945 was attributable not only to the abrupt transition from war to peace production following VJ-day but also to mine stoppages in October which curtailed shipments of bituminous coal to coke plants; failure of old byproduct-coke-oven batteries that had been pushed hard during the war; and the closing of a number of beehive-coke plants because of labor difficulties and lack of coal.

As coke production is geared closely to iron and steel operations, cut-backs in pig-iron requirements in 1945 naturally affected the activity of coking operations. As a consequence, byproduct-coke plants connected with iron and steel works, or "furnace" plants, operated at 83 percent of productive capacity compared with 93 percent in 1944, and nonfurnace or "merchant" plants dropped from 94 to 88 percent of capacity.

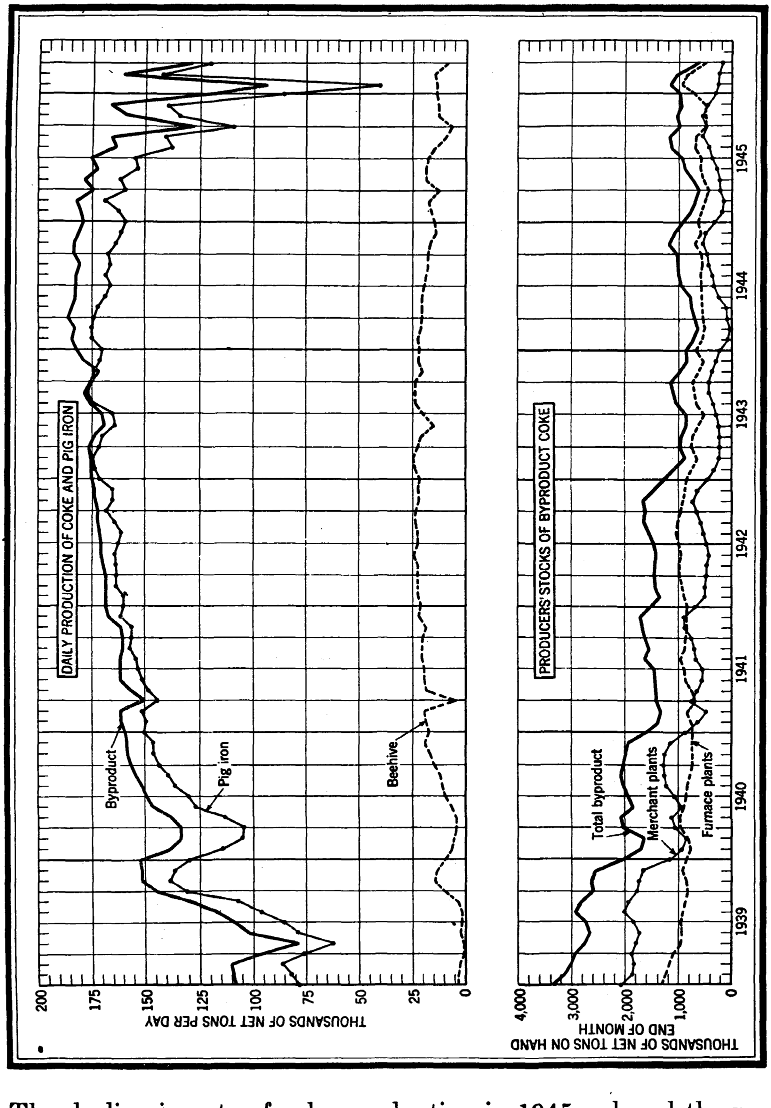

FIGURE 1.—Average daily production of beehive and byproduct coke and pig iron and producers' stocks of byproduct coke, 1939-45, by months.

The decline in rate of coke production in 1945 reduced the requirements of coking coal, and byproduct and beehive ovens carbonized 7 percent and 25 percent, respectively, less coal than in 1944. Although coking-coal requirements were substantially lower than in 1944, supplies of such coal in 1945 were inadequate, and it was necessary for the Solid Fuels Administration for War to continue regulatory measures promulgated in the war years to assure equitable distribution of byproduct-coking coal. These measures permitted that agency to divert byproduct or special purpose coal from industrial plants using this coal for steam raising and also from coke plants with adequate stock piles to coke plants with an insufficient supply to maintain maximum operation. The Bureau of Mines continued to work closely with the Solid Fuels Administration for War in collecting and compiling statistical data relating to requirements, consumption, stocks, and days' supply of coking coals at byproduct-coke plants.

The increase in Office of Price Administration maximum prices applicable to sales of bituminous coal shipped from mines in 1945 resulted in a sharp gain in the cost of coal delivered to coking plants. The average cost per net ton for bituminous coal charged into byproduct ovens advanced 4 percent over 1944 to $5.29 and approached the peak cost of $5.40 a ton in 1920. The cost of bituminous coal charged into beehive ovens soared to a new peak of $3.51 per ton, a gain of 6 percent over the previous maximum registered in 1944.

The disposal of coke for use in blast furnaces decreased 11 percent during 1945 and reflected the decline in steel-plant operations. The strong demand for coke for other purposes (for use in iron foundries, manufacturing water gas and producer gas, and miscellaneous industrial purposes) continued throughout the year, and shipments increased slightly over the 1944 total. Although coke shipments for domestic or household use increased 4 percent during the first 9 months of 1945 over the corresponding period of 1944, this gain was offset in part in the last quarter, and shipments for the entire year were less than 1 percent higher than the 1944 total (table 2).

According to data compiled by the Bureau of Mines from records of the United States Department of Commerce, export shipments of coke in 1945 increased 71 percent over 1944 and were the highest reported since 1918. This sharp increase was due primarily to the heavy shipments to Canada of reclaimed beehive coke recovered from huge waste banks in western Pennsylvania. It is estimated that shipments of reclaimed coke in 1945 constituted 20 percent of the total exports of all coke. Notwithstanding this large tonnage of reclaimed coke, export shipments of byproduct and beehive coke increased sharply and were well above those of recent years. Imports of coke were negligible and represented less than one-tenth of one percent of the total consumption of coke in the United States.

Because of the reduction in the quantity of coal carbonized compared with 1944, output of crude tar, ammonia (all forms), crude light oil, and coke-oven gas decreased 9 percent, 7 percent, 8 percent, and 10 percent, respectively, in 1945. However, yields of these byproducts per ton of coal charged varied only slightly from the 1944 figures (table 2). The value realized through their sale (excluding tar used by producers) declined 7 percent from 1944 and totaled $172,138,205. The value of all coke and breeze produced and byproducts sold decreased 5 percent from 1944 and totaled $699,216,012.

TABLE 1.—*Salient statistics of the byproduct and beehive coke industry in the United States in 1945*

	Byproduct	Beehive	Total
Coke produced—			
At merchant plants:			
Net tons	13,399,116	(1)	13,399,116
Value	$118,229,418		$118,229,418
At furnace plants:			
Net tons	48,695,172		48,695,172
Value	$351,960,921		$351,960,921
Total:			
Net tons	62,094,288	5,213,893	67,308,181
Value	$470,190,339	$38,349,703	$508,540,042
Screenings or breeze produced:			
Net tons	4,628,533	92,294	4,720,827
Value	$12,535,373	$96,747	$12,632,120
Coal charged into ovens:			
Bituminous:			
Net tons	87,214,163	8,134,629	95,348,792
Value	$460,927,459	$28,566,098	$489,493,557
Average per ton	$5.29	$3.51	$5.13
Anthracite:			
Net tons	322,601		322,601
Value	$1,567,616		$1,567,616
Average per ton	$4.86		$4.86
Total:			
Net tons	87,536,764	8,134,629	95,671,393
Value	$462,495,075	$28,566,098	$491,061,173
Average per ton	$5.28	$3.51	$5.13
Average yield in percent of total coal charged:			
Coke	70.94	64.10	70.35
Breeze (at plants actually recovering)	5.31	3.43	5.26
Ovens:			
In existence January 1	14,580	16,318	30,898
In existence December 31	14,510	12,179	26,689
Dismantled during year	176	4,505	4,681
In course of construction December 31	335		335
Annual capacity of ovens December 31 net tons	71,399,100	8,094,850	79,493,950
Coke used by producer—			
In blast furnaces:			
Net tons	34,365,834	240,547	34,606,381
Value	$256,729,973	$1,884,251	$258,614,224
In foundries:			
Net tons	43,936		43,936
Value	$384,697		$384,697
To make producer gas:			
Net tons	807,926		807,926
Value	$5,598,986		$5,598,986
To make water gas:			
Net tons	1,625,879		1,625,879
Value	$10,998,464		$10,998,464
For other purposes:			
Net tons	325,995	76,435	402,430
Value	$2,586,805	$718,976	$3,305,781
Disposal of coke:			
Sold to financially affiliated plants—			
For blast-furnace use:			
Net tons	10,518,776	1,725,385	12,244,161
Value	$65,476,552	$11,942,926	$77,419,478
For foundry use:			
Net tons	3,206		3,206
Value	$19,539		$19,539
For manufacture of water gas:			
Net tons	380,977		380,977
Value	$2,994,546		$2,994,546
For other purposes:			
Net tons	169,269	459	169,728
Value	$1,204,260	$3,833	$1,208,093

See footnotes at end of table.

TABLE 1.—*Salient statistics of the byproduct and beehive coke industry in the United States in 1945*—Continued

	Byproduct	Beehive	Total
Disposal of coke—Continued			
Sold to other consumers—			
For blast-furnace use:			
Net tons	2,026,012	2,126,367	4,152,379
Value	$15,937,579	$15,687,901	$31,625,480
For foundry use:			
Net tons	2,334,827	254,762	2,589,589
Value	$26,814,107	$2,155,918	$28,970,025
For manufacture of water gas:			
Net tons	1,076,144	187,697	1,263,841
Value	$8,927,407	$1,440,222	$10,367,629
For other industrial use:			
Net tons	1,852,871	433,901	2,286,772
Value	$15,517,471	$3,311,237	$18,828,708
For domestic use:			
Net tons	6,574,526	200,982	6,775,508
Value	$57,124,329	$1,461,402	$58,585,731
Disposal of screenings or breeze:			
Used by producer—			
For raising steam:			
Net tons	3,405,509	22,364	3,427,873
Value	$9,189,234	$21,492	$9,210,726
To make producer or water gas:			
Net tons	57,573		57,573
Value	$208,663		$208,663
For other purposes:			
Net tons	712,621	3,458	716,079
Value	$1,843,516	$6,355	$1,849,871
Sold:			
Net tons	1,088,890	89,505	1,178,395
Value	$2,998,426	$63,068	$3,061,494
Average receipts per ton sold (merchant sales):			
Furnace coke	$7.87	$7.38	$7.62
Foundry coke	$11.48	$8.46	$11.19
Water-gas coke	$8.30	$7.66	$8.20
Other industrial coke	$8.37	$7.63	$8.23
Domestic coke	$8.69	$7.27	$8.65
Screenings or breeze	$2.75	$0.70	$2.60
Stocks on January 1, 1946:			
Furnace net tons	425,438	2,455	427,893
Foundry do	24,509	270	24,779
Domestic and other do	477,052	2,089	479,141
Screenings or breeze do	1,022,561	20	1,022,581
Exports do	(1)	(1)	1,478,746
Imports do	(1)	(1)	51,964
Calculated consumption do	(1)	(1)	66,074,271
Byproducts produced:			
Tar gallons	696,307,311		696,307,311
Ammonium sulfate or equivalent pounds	1,749,437,753		1,749,437,753
Gas M cubic feet	904,476,118		904,476,118
Burned in coking process percent	37.27		37.27
Surplus sold or used do	61.28		61.28
Wasted do	1.45		1.45
Crude light oil gallons	245,687,253		245,687,253
Yield of byproducts per ton of coal:			
Tar do	7.95		7.95
Ammonium sulfate or equivalent pounds	20.22		20.22
Gas M cubic feet	10.33		10.33
Crude light oil gallons	2.84		2.84
Value of byproducts sold:			
Tar:			
Sold	$21,827,890		$21,827,890
Used by producer	$5,905,645		$5,905,645
Ammonium sulfate or equivalent	$22,090,179		$22,090,179
Gas (surplus)	$87,745,022		$87,745,022
Crude light oil and derivatives	$29,448,732		$29,448,732
Other byproducts [2]	$11,026,382		$11,026,382
Total value of coke and breeze produced and byproducts sold [3]	$660,769,562	$38,446,450	$699,216,012

[1] Not separated.
[2] Includes naphthalene, tar derivatives, and miscellaneous byproducts.
[3] Includes value of tar used by producer.

TABLE 2.—*Statistical trends of the byproduct and beehive coke industry in the United States, 1937 and 1942–45*

	1937	1942	1943	1944	1945
Coke produced:					
Byproduct net tons	49,210,748	62,294,909	63,742,676	67,064,795	62,094,288
Beehive do	3,164,721	8,274,035	7,933,387	6,973,022	5,213,893
Total do	52,375,469	70,568,944	71,676,063	74,037,817	67,308,181
Percent from byproduct ovens	94.0	88.3	88.9	90.6	92.3
Stocks of coke, end of year net tons	2,595,287	1,489,049	862,100	1,124,685	931,813
Exports, all coke do	526,683	839,582	994,607	866,835	1,478,746
Imports, all coke do	286,364	108,782	98,127	63,004	51,964
Consumption, calculated, all coke do	51,271,929	70,107,181	71,406,532	72,971,401	66,074,271
Disposal of coke, all coke sold or used:					
Furnace coke net tons	36,751,969	55,491,570	57,690,160	57,481,353	51,002,921
Foundry coke do	2,038,822	2,591,576	2,606,889	2,511,854	2,636,731
Other industrial (including producer and water gas) net tons	4,597,894	6,598,842	6,999,884	6,978,062	6,937,553
Domestic coke do	8,107,518	6,061,694	4,885,528	6,717,543	6,775,508
Ovens:					
Byproduct, in existence, end of year	12,718	13,303	14,253	14,580	14,510
Beehive, in existence, end of year	12,194	16,295	17,666	16,318	12,179
Byproduct, under construction, end of year	259	1,327	528	180	335
Cost of coal charged, byproduct ovens, average per ton	$3.74	$4.38	$4.75	$5.08	$5.28
Prices of coke:					
Average spot price of Connellsville furnace coke, f. o. b. ovens	$4.29	$6.01	$6.46	$7.00	$7.29
Average realization on byproduct coke sold (merchant sales):					
Furnace coke	$4.34	$6.58	$7.26	$7.59	$7.87
Foundry coke	$8.47	$10.15	$10.17	$11.03	$11.48
Other industrial (including water gas)	$6.08	$7.30	$7.43	$8.12	$8.35
Domestic	$6.53	$7.88	$8.21	$8.63	$8.69
Yield of byproducts per ton of coal charged:					
Tar gallons	8.67	8.41	8.11	8.13	7.95
Ammonium sulfate or equivalent pounds	21.84	20.85	20.32	20.29	20.22
Light oil gallons	2.86	2.88	2.83	2.87	2.84
Surplus gas sold or used M cubic feet	6.66	6.65	6.59	6.58	6.33
Average gross receipts for byproducts, per ton of coke produced:					
Tar sold and used	$0.502	$0.473	$0.463	$0.458	$0.447
Ammonia and its compounds	$0.326	$0.348	$0.355	$0.324	$0.356
Light oil and its derivatives (including naphthalene)	$0.435	$0.501	$0.546	$0.552	$0.503
Surplus gas sold or used	$1.483	$1.426	$1.390	$1.403	$1.413
Total byproducts including breeze	$2.974	$3.100	$3.123	$3.102	$3.069

WAR AGENCY REGULATIONS

Virtually all wartime allocation controls on coke and related products were rescinded by the War Production Board immediately following the surrender of Japan. This action was taken to facilitate movement of these materials to plants engaged in manufacturing civilian goods. Beginning with the revoking of allocation control on pyridine on August 1, 1945, control over coke was rescinded August 24; coal tar, benzol, toluol, xylol, naphthalene, tar-acid oil, carbolates, phenols, and substituted phenols August 31; and ammonium sulfate September 30. In October, because of the lack of coking coal, the WPB reinstated control over coke by issuing Direction 4 to Priorities Regulation 32 on October 10, 1945, effective October 15, 1945. This direction limited inventories on coke to a 20-day supply and remained in effect until November 15, 1945.

Government control over the distribution of coking coals (special purpose coals) remained under the jurisdiction of the Solid Fuels Administration for War during 1945. Regulation 24, issued January 1945, prohibited the shipment and receipt of special purpose coals during the fuel year, 1945–46, unless such coal was covered by contract entered into before February 1, 1945, and specifically approved by SFAW or pursuant to written permission or a direction issued by that agency. Coke plants in 1945 were again assured of first preference in the distribution of bituminous coal under provisions of SFAW Regulation 27, issued March 14, 1945. Control over the distribution of domestic coke within the United States was revoked on November 1, 1945, under terms of SFAW Order 27, issued October 22, 1945.

Maximum price regulations covering coke and related products in effect at the end of 1944 were continued in 1945, with several upward revisions in the ceiling prices of byproduct and beehive coke. On May 26, 1945, Amendment 5 to MPR 77 was issued by the OPA, raising the price of beehive furnace coke produced in hand-drawn and machine-drawn ovens, respectively, located in the Connellsville district,[1] \$0.25 and \$0.50 per net ton to \$8.00 and \$7.50 f. o. b. ovens. Maximum prices for beehive-oven coke, other than furnace coke, were adjusted by the same amounts.

To compensate for increased manufacturing costs of byproduct coke, the OPA issued Amendment 4 to MPR 29 on August 7, 1945, which increased the average sales price of byproduct coke \$0.40 per ton.

TECHNOLOGIC DEVELOPMENTS

Continued and expanded interest in coal carbonization in 1945 is shown by the number of new developments reported. A recent development in oven construction was the Koppers "saddle brick" designed by the Koppers Co., Inc., Pittsburgh, Pa., to increase the strength of walls. The Wilputte Coke Oven Corp., New York, N. Y., reported the following improvements in coke-oven design: Thicker oven tops, advanced equipment for the mechanical charging of coal, correct location of charging holes, reversible compensating mains to increase yields and improve the quality of byproducts,[2] and improved self-sealing oven doors and door-handling equipment.[3]

The Bureau of Mines continued to cooperate with industry in developing means to maintain and improve coke quality in the face of the coking-coal shortage. Special studies were made by Bureau engineers on the carbonization properties of low- and medium-volatile bituminous coal that might be used to increase the Nation's supply of proved coking coal, reserves of which are being depleted rapidly.[4] Studies on coal relating to carbonizing properties, plasticity, expansion, oxidation, and control of bulk density of coke-oven charges were continued.[5]

Tests on the utilization of Utah coal and blends of that coal with Oklahoma low-volatile coal and char for the production of satisfactory blast-furnace coke were conducted at Fontana, Calif.[6]

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[1] Western Pennsylvania and Barbour, Monongalia, Preston, and Upshur Counties, W. Va.

[2] Wilputte, Louis M., and Wethly, Frans, Recent Improvements in Coke-Oven Design and Operation: Blast Fur. and Steel Plant, vol. 34, No. 3, March 1946, pp. 355–367.

[3] *Blast Furance and Steel Plant*, Wilputte Coke Oven Corporation Announces Improvement in Equipment: Vol. 34, No. 1, January 1946, pp. 117 and 120.

[4] Reynolds, D. A., and Davis, J. D., Blending Properties of Low- and Medium-Volatile Coals as Determined in the BM–AGA Apparatus: Bureau of Mines Rept. of Investigations 3936, 1946, 20 pp.

[5] Fieldner, A. C., and Brewer, R. E., Annual Report of Research and Technological Work on Coal: Bureau of Mines Inf. Circ. 7352, 1946, 103 pp.

[6] Thompson, J. Howard, Beneficiation of Blast-Furnace Coke at the Kaiser Steel Co., Fontana, Calif.: Blast Fur. and Steel Plant, vol. 34, No. 2, February 1946, pp. 225–230; No. 3, March 1946, pp. 350–354; No. 4, April 1946, pp. 475–479; and No. 5, May 1946, pp. 584–586 and 624.

The Illinois State Geological Survey reported that an electrically heated slot-type test oven was used throughout the year in a program designed to determine suitable blends of Illinois coal for metallurgical coke production. The yields and properties of the coke and byproducts recovered from this small experimental oven compare closely with those obtained by carbonizing the same coal in commercial slot-type ovens. Because of the rapid depletion of the reserves of high-rank eastern bituminous coking coal and transportation problems, the Illinois Geological Survey, aided by the Office of Production Research and Development, WPB, initiated this research program to study the problem of substituting midwestern coals for a portion of the eastern high-volatile coals now being carbonized in midwestern coke ovens.[7]

Ammonia-recovery systems of a new type for the production of ammonium sulfate crystals of controlled size are reported by Wethly [8] and Schulte.[9] The systems consist essentially of a low-differential-classification saturator in which more than 99.8 percent of the ammonia is removed from the gas, with less seal depth. It is maintained that operating costs are lower than those for a normal saturator and that the product compares satisfactorily with the best grades of sulfate produced by synthetic ammonia plants.

A method for purifying coke-oven gas with respect to the separation and recovery of hydrogen sulfide was developed by H. A. Gollmar and is described in United States Patent 2,379,076, issued June 26, 1945, and assigned to the Koppers Co., Inc. In this sulfur-recovery process, heat from the raw coke-oven gas is used in the actification step, resulting in a substantial reduction in steam consumption and in the load of the primary coolers.

The Mellon Institute of Industrial Research, in its Thirty-third Annual Report, covering the year ended February 28, 1946,[10] summarized studies conducted on problems concerning chemicals obtained in byproduct-coking operations, including the recovery of compounds from coke-oven gas, the elimination of wastes, the improvement of quality of products, and the industrial uses of coal chemicals.

Among the new developments reported were a new process for the manufacture of sodium cyanide; a process for the separation and recovery of ammonium thiosulfate and ammonium thiocyanate from plant waste solutions; and the construction of a universal-type 3-inch fractionating column, considered the most effective device of this kind and size ever built, for use in tar distillation.

SCOPE OF REPORT

This report contains final annual data for 1945 on the production of both byproduct and beehive coke, coke breeze, coal chemicals, and city-gas-company statistics. In accordance with usual procedure, most of the tables herein include comparable data for 3 or 4 preceding years. In addition to the customary statistics on byproduct and beehive coke, there are included salient statistics on low- and medium-

[7] Reed, Frank H., Jackson, Harold W., and Henline, P. W., Coke from Illinois coal: Ind. Eng. Chem., vol. 37, No. 6, pp. 360–366.
[8] Wethly, Frans, Production of Ammonium Sulfate from Coke-Oven Gas: Blast Fur. and Steel Plant, vol. 33, No. 8, August 1945, pp. 976–980.
[9] Schulte, E. V., Recent Developments in Producing Ammonium Sulfate: Blast Fur. and Steel Plant, vol. 34, No. 5, May 1946, pp. 573–578.
[10] Chemical Engineering News, Researches of Mellon Institute 1945–46: Vol. 24, Apr. 10, 1946, pp. 906–15, 926–27.

temperature carbonization (table 3) and similar data for gas-house coke (table 4). However, since only coke made by high-temperature carbonization of coal in byproduct and beehive ovens is suitable for metallurgical purposes, statistics in this report are confined thereto unless otherwise specified. Coke is also made by other processes not included in this report, including the refining of petroleum and of crude tar. The production of petroleum coke in the United States in 1945 increased 12 percent over 1944 and totaled 2,023,000 net tons; output of coal-tar-pitch coke was 87,000 tons. Because of the extremely low ash content of petroleum and pitch coke, it is in demand as a source of comparatively pure carbon and is employed widely in the manufacture of carbon electrodes. A major proportion of petroleum coke is usually disposed of locally for miscellaneous purposes or domestic fuel.

The standard unit of measurement in the coke industry is the short or net ton of 2,000 pounds and unless otherwise specified is employed throughout this chapter.

MEDIUM- AND LOW-TEMPERATURE COKE

TABLE 3.—*Salient statistics of medium- and low-temperature carbonization plants in the United States in 1945*

Coke produced:		
Net tons		190,089
Value		$1,072,374
Screenings or breeze produced:		
Net tons		29,451
Value		$52,760
Coal carbonized:		
Net tons		327,480
Value		$577,385
Average per ton		$1.76
Average yield in percent of coal carbonized:		
Coke		58.05
Breeze		15.81
Ovens and retorts:		
In existence December 31		31
Annual coke capacity December 31	net tons	185,100
Disposal of coke:		
Sold to other consumers—		
For industrial use:		
Net tons		10,841
Value		$65,099
For domestic use:		
Net tons		118,780
Value		$729,091
Disposal of screenings or breeze:		
Sold:		
Net tons		32,462
Value		$57,745
Average receipts per ton sold:		
Industrial coke		$6.00
Domestic coke		$6.14
Screenings or breeze		$1.78
Stocks on January 1, 1946:		
Domestic and other coke	net tons	56,056
Screenings or breeze	do	33,700
Byproducts produced:		
Tar	gallons	3,200,332
Gas	M cubic feet	1,144,982
Burned in coking process	percent	55.53
Surplus sold or used	do	20.37
Wasted	do	24.10
Yield of byproducts per ton of coal:		
Tar	gallons	9.77
Gas	M cubic feet	6.15
Value of byproducts sold:		
Tar and its derivatives		$273,989
Gas (surplus)		$37,890
Total value of coke and breeze produced and byproducts sold		$1,437,013

GAS-HOUSE COKE

TABLE 4.—*Salient statistics of the coal-gas industry in the United States in 1945*

	Horizontal retorts	Vertical retorts and gas ovens	Total
Coke produced:			
Net tons	362, 381	496, 865	859, 246
Value	$2, 916, 316	$4, 365, 879	$7, 282, 195
Screenings or breeze produced net tons	26, 790	72, 301	99, 091
Coal charged into retorts:			
Net tons	575, 379	830, 732	1, 406, 111
Value	$3, 921, 292	$5, 667, 358	$9, 588, 650
Average per ton	$6. 82	$6. 82	$6. 82
Average yield in percent of coal charged:			
Coke	62. 98	59. 81	61. 11
Breeze (at plants actually recovering)	7. 55	9. 03	8. 58
Retorts:			
In existence December 31	2, 237	[1] 589	2, 826
In operation December 31	1, 616	[1] 583	2, 199
Annual coal capacity net tons	865, 800	950, 500	1, 816, 300
Coke used by producer—			
For manufacture of water gas:			
Net tons	81, 830	63, 028	144, 858
Value	$684, 366	$541, 015	$1, 225, 381
For manufacture of producer gas:			
Net tons	------------	36, 114	36, 114
Value	------------	$201, 988	$201, 988
For bench fuel:			
Net tons	96, 763	86, 828	183, 591
Value	$720, 657	$726, 270	$1, 446, 927
For other purposes:			
Net tons	20, 006	8, 714	28, 720
Value	$132, 410	$68, 414	$200, 824
Coke sold to other consumers—			
For manufacture of water gas:			
Net tons	10, 454	13, 547	24, 001
Value	$89, 939	$111, 642	$201, 581
For domestic use:			
Net tons	150, 002	281, 359	431, 361
Value	$1, 282, 872	$2, 652, 971	$3, 935, 843
For other industrial use:			
Net tons	8, 632	13, 970	22, 602
Value	$49, 703	$121, 027	$170, 730
Stocks on January 1, 1946:			
Coke net tons	23, 121	45, 798	68, 919
Breeze do	8, 797	19, 816	28, 613
Byproducts produced:			
Tar:			
Production gallons	7, 267, 925	12, 568, 915	19, 836, 840
Sales:			
For refining:			
Gallons	3, 695, 718	8, 087, 562	11, 783, 280
Value	$172, 117	$376, 786	$548, 903
For fuel:			
Gallons	------------	------------	------------
Value	------------	------------	------------
For other purposes:			
Gallons	4, 568, 041	4, 488, 439	9, 056, 480
Value	$169, 584	$236, 847	$406, 431
Stocks on January 1, 1946 gallons	1, 990, 841	1, 951, 566	3, 942, 407
Per ton of coal charged do	12. 63	15. 13	14. 11
Ammonia liquor (NH_3 content):			
Production pounds	------------	1, 230, 307	1, 230, 307
Sales do	------------	1, 227, 612	1, 227, 612
Value	------------	$28, 815	$28, 815
Stocks on January 1, 1946 pounds	------------	119, 023	119, 023
Per ton of coal charged do	------------	3. 29	3. 29

[1] Includes 15 gas ovens.

BYPRODUCT AND BEEHIVE COKE AND COKE BREEZE

GROWTH OF INDUSTRY

TABLE 5.—*Statistical summary illustrating growth of coke industry in the United States, 1880 and 1890–1945*

Year	Production (million net tons)			Percent of total production from byproduct ovens	Ovens in existence		Byproduct ovens under construction at end of year	Coal charged (million net tons)	Yield of coke from coal (percent)	Average value of coke per ton at plant	Total value at plant (million dollars)			
	Byproduct	Beehive	Total		Byproduct	Beehive					Beehive coke	Byproduct coke	All byproducts [1]	Total coke and byproducts
1880	------	3.3	3.3	------	------	12,372	------	5.2	63.7	$1.99	7	------	------	7
1890	------	11.5	11.5	------	------	37,158	------	18.0	63.9	2.02	23	------	------	23
1891	------	10.4	10.4	------	------	40,057	------	16.3	63.3	1.97	20	------	------	20
1892	------	12.0	12.0	------	------	42,002	------	18.8	63.8	1.96	24	------	------	24
1893	0.01	9.5	9.5	0.1	12	44,189	------	14.9	63.5	1.74	17	------	(2)	(2)
1894	.02	9.2	9.2	.2	12	44,760	60	14.4	64.0	1.34	12	------	(2)	(2)
1895	.02	13.3	13.3	.1	72	45,493	60	20.8	64.0	1.44	19		(2)	(2)
1896	.1	11.7	11.8	.7	160	46,784	120	18.7	63.1	1.84	22		(2)	(2)
1897	.3	13.0	13.3	2.0	280	47,388	240	20.9	63.6	1.66	22		(2)	(2)
1898	.3	15.7	16.0	1.8	520	47,863	500	25.2	63.6	1.59	26		(2)	(2)
1899	.9	18.8	19.7	4.6	1,020	48,583	65	30.2	65.1	1.76	35		(2)	(2)
1900	1.1	19.4	20.5	5.2	1,085	57,399	1,096	32.1	63.9	2.31	47		(2)	(2)
1901	1.2	20.6	21.8	5.4	1,165	62,786	1,533	34.2	63.7	2.04	44		------	------
1902	1.4	24.0	25.4	5.5	1,663	67,406	1,346	39.6	64.1	2.49	63		(2)	(2)
1903	1.9	23.4	25.3	7.4	1,956	77,378	1,335	39.4	64.1	2.63	66		(2)	(2)
1904	2.6	21.1	23.7	11.0	2,910	80,689	832	36.5	64.8	1.95	46		(2)	(2)
1905	3.4	28.8	32.2	10.7	3,103	84,405	417	49.5	65.1	2.25	72		(2)	(2)
1906	4.6	31.8	36.4	12.5	3,547	90,354	112	55.7	65.3	2.52	92		(2)	(2)
1907	5.6	35.2	40.8	13.8	3,684	95,996	330	61.9	65.8	2.74	90	22	8	120
1908	4.2	21.8	26.0	16.1	3,799	97,419	240	39.4	66.0	2.40	48	14	7	69
1909	6.2	33.1	39.3	15.9	3,989	99,993	949	59.4	66.2	2.29	70	20	8	98
1910	7.1	34.6	41.7	17.1	4,078	100,362	1,200	63.1	66.1	2.39	75	25	8	108
1911	7.9	27.7	35.6	22.1	4,624	99,255	698	53.3	66.7	2.37	57	27	10	94
1912	11.1	32.9	44.0	25.3	5,211	97,019	793	65.6	67.1	2.54	69	43	14	126
1913	12.7	33.6	46.3	27.5	5,688	96,962	504	69.2	66.9	2.78	80	49	17	146
1914	11.2	23.4	34.6	32.5	5,809	93,946	644	51.6	66.9	2.56	50	38	18	106
1915	14.1	27.5	41.6	33.8	6,268	93,110	1,191	61.8	67.2	2.54	57	49	30	136
1916	19.1	35.4	54.5	35.0	7,283	91,581	2,084	81.6	66.8	3.13	96	75	62	233
1917	22.4	33.2	55.6	40.4	7,869	88,027	2,260	83.8	66.4	5.36	159	139	68	366
1918	26.0	30.5	56.5	46.0	9,279	84,635	1,815	85.0	66.4	6.77	189	193	77	459
1919	25.1	19.1	44.2	56.9	10,379	82,560	877	65.6	67.4	5.85	98	160	68	326
1920	30.8	20.5	51.3	60.0	10,881	75,298	396	76.2	67.4	9.27	163	313	105	581
1921	19.8	5.5	25.3	78.1	11,142	66,014	85	37.2	68.0	5.84	30	118	68	216
1922	28.5	8.6	37.1	76.9	11,212	63,958	403	54.3	68.3	6.42	50	188	95	333
1923	37.6	19.4	57.0	66.0	11,156	62,349	629	84.4	67.5	6.56	116	257	131	504
1924	34.0	10.3	44.3	76.8	11,413	60,432	247	65.0	68.1	5.51	48	196	120	364
1925	39.9	11.4	51.3	77.9	11,290	57,587	429	74.5	68.8	5.12	52	211	143	406
1926	44.4	12.5	56.9	78.0	11,716	52,558	978	82.9	68.6	5.41	57	251	157	465
1927	43.9	7.2	51.1	85.9	12,475	49,795	289	74.4	68.6	5.13	30	232	160	422
1928	48.3	4.5	52.8	91.5	12,544	41,288	145	77.2	68.4	4.79	16	237	177	430
1929	53.4	6.5	59.9	89.2	12,649	30,082	408	86.8	69.0	4.66	23	256	192	471
1930	45.2	2.8	48.0	94.2	12,831	23,907	276	69.8	68.7	4.36	10	200	168	378
1931	32.4	1.1	33.5	96.6	13,108	21,588	------	48.6	68.9	4.83	4	158	125	287
1932	21.1	.7	21.8	97.0	13,053	19,440	------	31.9	68.3	4.79	2	103	88	193
1933	26.7	.9	27.6	96.7	13,053	16,857	------	40.1	68.7	4.46	3	120	95	218
1934	30.8	1.0	31.8	96.8	12,963	14,206	------	46.0	69.2	5.01	4	155	104	263

See footnotes at end of table.

TABLE 5.—*Statistical summary illustrating growth of coke industry in the United States, 1880 and 1890–1945*—Continued

Year	Production (million net tons)			Percent of total production from byproduct ovens	Ovens in existence		Byproduct ovens under construction at end of year	Coal charged (million net tons)	Yield of coke from coal (percent)	Average value of coke per ton at plant	Total value at plant (million dollars)			
	Byproduct	Beehive	Total		Byproduct	Beehive					Beehive coke	Byproduct coke	All byproducts[1]	Total coke and byproducts
1935	34.2	0.9	35.1	97.4	12,860	13,674	122	50.5	69.6	$5.03	4	173	113	290
1936	44.6	1.7	46.3	96.3	12,849	13,012	305	65.9	70.2	5.02	7	226	136	369
1937	49.2	3.2	52.4	94.0	12,718	12,194	259	74.5	70.3	4.98	14	247	151	412
1938	31.7	.8	32.5	97.4	12,724	10,816	146	46.6	69.7	5.14	4	163	116	283
1939	42.9	1.4	44.3	96.7	12,732	10,934	-------	63.5	69.8	4.80	6	207	142	355
1940	54.0	3.1	57.1	94.6	12,734	15,150	492	81.4	70.1	4.80	14	260	168	442
1941	58.5	6.7	65.2	89.7	13,016	18,669	181	93.1	70.0	5.41	37	316	183	536
1942	62.3	8.3	70.6	88.3	13,303	16,295	1,327	100.8	70.0	6.03	47	378	204	629
1943	63.8	7.9	71.7	88.9	14,253	17,666	528	102.5	70.0	6.64	52	424	210	686
1944	67.0	7.0	74.0	90.6	14,580	16,318	180	105.3	70.3	7.13	49	479	208	736
1945	62.1	5.2	67.3	92.3	14,510	12,179	335	95.7	70.4	7.56	38	470	191	699

[1] Value for tar up to and including 1917 represented that of tar "obtained and sold," which did not always include value of tar used by producer. Beginning with 1918, tar used by producer is specifically included. Value of breeze produced at byproduct plants is included for those years for which it was reported, namely, 1916, 1917, and 1919–45. For other byproducts, only value of those sold is included. Value of breeze produced at beehive plants is not included, as it has usually been much less than a million dollars.
[2] No accurate data on value of the byproducts available.

MONTHLY AND WEEKLY PRODUCTION

TABLE 6.—*Byproduct, beehive, and total coke produced in the United States, 1937 and 1943–45, by months and average per day, in net tons* [1]

Month	1937 Total	1937 Daily average	1943 Total	1943 Daily average	1944 Total	1944 Daily average	1945 Total	1945 Daily average
Byproduct:								
January	4, 360, 700	140, 700	5, 400, 600	174, 200	5, 663, 400	182, 700	5, 621, 100	181, 300
February	3, 992, 900	142, 600	4, 907, 500	175, 300	5, 360, 800	184, 900	5, 101, 000	182, 200
March	4, 495, 500	145, 000	5, 431, 800	175, 200	5, 692, 800	183, 700	5, 691, 100	183, 600
April	4, 350, 900	145, 000	5, 280, 800	176, 000	5, 581, 700	186, 000	5, 269, 200	175, 600
May	4, 479, 700	144, 500	5, 406, 600	174, 400	5, 728, 000	184, 800	5, 572, 900	179, 800
June	4, 024, 800	134, 200	5, 066, 900	168, 900	5, 472, 800	182, 400	5, 207, 500	173, 600
July	4, 423, 900	142, 700	5, 273, 100	170, 100	5, 663, 800	182, 700	5, 473, 700	176, 600
August	4, 573, 400	147, 500	5, 473, 600	176, 600	5, 670, 300	182, 900	5, 111, 300	164, 900
September	4, 427, 800	147, 600	5, 347, 900	178, 300	5, 412, 300	180, 400	5, 036, 900	167, 900
October	4, 035, 100	130, 200	5, 445, 500	175, 700	5, 671, 900	183, 000	3, 974, 100	128, 200
November	3, 222, 300	107, 400	5, 152, 800	171, 800	5, 507, 300	183, 600	4, 827, 900	160, 900
December	2, 823, 800	91, 100	5, 555, 600	179, 200	5, 639, 700	181, 900	5, 207, 600	168, 000
	49, 210, 800	134, 800	63, 742, 700	174, 600	67, 064, 800	183, 200	62, 094, 300	170, 100
Beehive:								
January	274, 300	10, 600	662, 700	21, 400	679, 900	21, 900	460, 700	14, 900
February	294, 600	12, 300	644, 100	23, 000	644, 200	22, 200	456, 000	16, 300
March	357, 300	13, 200	753, 200	24, 300	667, 600	21, 500	534, 800	17, 200
April	309, 700	11, 900	686, 500	22, 900	614, 500	20, 500	377, 000	12, 600
May	326, 500	12, 600	657, 500	21, 200	645, 300	20, 800	559, 900	18, 000
June	274, 800	10, 600	420, 400	14, 000	614, 900	20, 500	561, 000	18, 700
July	285, 100	11, 000	633, 900	20, 400	605, 100	19, 500	550, 800	17, 700
August	259, 000	10, 000	715, 600	23, 100	572, 500	18, 500	456, 400	14, 700
September	253, 900	9, 800	711, 600	23, 700	516, 200	17, 200	297, 800	9, 900
October	225, 500	8, 700	730, 400	23, 600	526, 700	17, 000	198, 100	6, 400
November	168, 800	6, 500	607, 000	20, 200	481, 200	16, 000	367, 700	12, 300
December	135, 200	5, 200	710, 500	22, 900	404, 900	13, 100	393, 700	12, 700
	3, 164, 700	10, 200	7, 933, 400	21, 700	6, 973, 000	19, 100	5, 213, 900	14, 300
Total coke:								
January	4, 635, 000	151, 300	6, 063, 300	195, 600	6, 343, 300	204, 600	6, 081, 800	196, 200
February	4, 287, 500	154, 900	5, 551, 600	198, 300	6, 005, 000	207, 100	5, 557, 000	198, 500
March	4, 852, 800	158, 200	6, 185, 000	199, 500	6, 360, 400	205, 200	6, 225, 900	200, 800
April	4, 660, 600	156, 900	5, 967, 300	198, 900	6, 196, 200	206, 500	5, 646, 200	188, 200
May	4, 806, 200	157, 100	6, 064, 100	195, 600	6, 373, 300	205, 600	6, 132, 800	197, 800
June	4, 299, 600	144, 800	5, 487, 300	182, 900	6, 087, 700	202, 900	5, 768, 500	192, 300
July	4, 709, 000	153, 700	5, 907, 000	190, 500	6, 268, 900	202, 200	6, 024, 500	194, 300
August	4, 832, 400	157, 500	6, 189, 200	199, 700	6, 242, 800	201, 400	5, 567, 700	179, 600
September	4, 681, 700	157, 400	6, 059, 500	202, 000	5, 928, 500	197, 600	5, 334, 700	177, 800
October	4, 260, 600	138, 900	6, 175, 900	199, 300	6, 198, 600	200, 000	4, 172, 200	134, 600
November	3, 391, 100	113, 900	5, 759, 800	192, 000	5, 988, 500	199, 600	5, 195, 600	173, 200
December	2, 959, 000	96, 300	6, 266, 100	202, 100	6, 044, 600	195, 000	5, 601, 300	180, 700
	52, 375, 500	145, 000	71, 676, 100	196, 300	74, 037, 800	202, 300	67, 308, 200	184, 400

[1] Before 1941 daily average production of beehive coke was calculated by subtracting Sundays and holidays in each month; 1942–45 daily average has been calculated by dividing total monthly production by total number of days in month.

TABLE 7.—*Beehive coke produced in the United States in 1945, by weeks*

[Estimated from railroad shipments]

Week ended—	Net tons	Week ended—	Net tons	Week ended—	Net tons
Jan. 6	[1] 76, 800	May 19	123, 000	Sept. 29	66, 500
Jan. 13	100, 100	May 26	130, 900	Oct. 6	42, 400
Jan. 20	111, 700	June 2	126, 500	Oct. 13	17, 700
Jan. 27	95, 600	June 9	133, 300	Oct. 20	19, 300
Feb. 3	99, 200	June 16	131, 200	Oct. 27	63, 400
Feb. 10	119, 800	June 23	124, 300	Nov. 3	76, 000
Feb. 17	107, 100	June 30	129, 500	Nov. 10	77, 500
Feb. 24	125, 800	July 7	108, 800	Nov. 17	76, 400
Mar. 3	132, 000	July 14	128, 000	Nov. 24	75, 100
Mar. 10	128, 900	July 21	130, 300	Dec. 1	90, 400
Mar. 17	127, 300	July 28	126, 700	Dec. 8	84, 500
Mar. 24	135, 000	Aug. 4	117, 400	Dec. 15	87, 600
Mar. 31	131, 400	Aug. 11	122, 700	Dec. 22	86, 500
Apr. 7	75, 000	Aug. 18	73, 500	Dec. 29	73, 600
Apr. 14	68, 600	Aug. 25	93, 500	Dec. 31	[2] 25, 500
Apr. 21	106, 600	Sept. 1	97, 600		
Apr. 28	131, 300	Sept. 8	77, 300		5, 213, 900
May 5	132, 800	Sept. 15	78, 000		
May 12	125, 900	Sept. 22	68, 100		

[1] 6 days.
[2] 2 days.

TABLE 8.—*Byproduct coke produced in the United States in 1945, by months and States, in net tons*

[Based upon reports from all producers]

State	January	February	March	April	May	June	July
Alabama	482, 700	429, 900	481, 400	342, 700	472, 800	399, 400	482, 700
California	27, 300	23, 000	25, 200	25, 000	25, 800	22, 100	20, 800
Colorado	58, 200	52, 400	57, 200	55, 000	45, 600	53, 200	55, 900
Illinois	333, 200	301, 800	342, 000	328, 400	346, 000	325, 200	328, 400
Indiana	694, 800	623, 300	700, 000	683, 400	689, 700	666, 500	693, 900
Maryland	174, 300	159, 400	177, 000	171, 000	176, 600	172, 800	175, 400
Massachusetts	101, 700	93, 800	103, 500	97, 600	101, 300	95, 400	94, 700
Michigan	248, 900	227, 100	249, 800	239, 100	246, 300	234, 300	247, 100
Minnesota	74, 400	65, 300	72, 100	70, 400	73, 100	66, 700	66, 300
New Jersey	109, 800	100, 500	115, 800	106, 600	106, 000	108, 700	112, 200
New York	485, 000	456, 700	506, 400	505, 200	496, 200	504, 300	518, 700
Ohio	835, 800	779, 400	892, 100	858, 900	875, 900	819, 800	831, 600
Pennsylvania	1, 456, 600	1, 298, 800	1, 431, 100	1, 268, 200	1, 386, 500	1, 242, 300	1, 326, 500
Tennessee	21, 000	19, 600	20, 800	19, 900	21, 100	20, 200	20, 500
Texas	18, 300	14, 200	14, 300	14, 600	16, 100	13, 700	16, 500
Utah	86, 400	77, 800	89, 400	73, 600	72, 700	66, 700	61, 000
West Virginia	222, 200	205, 000	226, 400	224, 700	232, 600	216, 100	234, 000
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	190, 500	173, 000	186, 600	184, 900	188, 600	180, 100	187, 500
	5, 621, 100	5, 101, 000	5, 691, 100	5, 269, 200	5, 572, 900	5, 207, 500	5, 473, 700
At merchant plants	1, 186, 600	1, 084, 700	1, 191, 600	1, 150, 100	1, 174, 400	1, 128, 100	1, 162, 100
At furnace plants	4, 434, 500	4, 016, 300	4, 499, 500	4, 119, 100	4, 398, 500	4, 079, 400	4, 311, 600

State	August	September	October	November	December	Total
Alabama	462, 200	446, 600	471, 700	455, 400	473, 400	5, 400, 900
California	22, 100	18, 200	15, 900	14, 900	15, 800	256, 100
Colorado	54, 700	53, 200	51, 600	52, 100	50, 000	639, 100
Illinois	290, 400	268, 600	233, 200	276, 100	308, 200	3, 681, 500
Indiana	634, 100	652, 400	507, 200	620, 200	648, 700	7, 814, 200
Maryland	175, 900	166, 500	143, 000	163, 600	169, 100	2, 024, 600
Massachusetts	95, 300	98, 500	71, 600	95, 000	101, 100	1, 149, 500
Michigan	244, 100	238, 200	198, 600	193, 400	239, 100	2, 806, 000
Minnesota	67, 600	65, 800	65, 200	67, 200	71, 500	825, 600
New Jersey	113, 800	108, 600	85, 200	106, 800	110, 000	1, 284, 000
New York	503, 600	498, 600	408, 700	441, 200	465, 400	5, 790, 000
Ohio	772, 400	745, 900	465, 400	721, 500	807, 000	9, 405, 700
Pennsylvania	1, 186, 300	1, 229, 200	877, 300	1, 225, 700	1, 326, 600	15, 255, 100
Tennessee	18, 100	17, 900	18, 200	19, 200	20, 500	237, 000
Texas	13, 600	15, 800	3, 200	------	------	140, 300
Utah	56, 500	39, 500	42, 000	32, 800	32, 900	731, 300
West Virginia	211, 800	189, 000	159, 700	163, 500	177, 500	2, 462, 500
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	188, 800	184, 400	156, 400	179, 300	190, 800	2, 190, 900
	5, 111, 300	5, 036, 900	3, 974, 100	4, 827, 900	5, 207, 600	62, 094, 300
At merchant plants	1, 138, 200	1, 100, 300	924, 700	1, 034, 700	1, 123, 600	13, 399, 100
At furnace plants	3, 973, 100	3, 936, 600	3, 049, 400	3, 793, 200	4, 084, 000	48, 695, 200

TABLE 9.—*Beehive coke produced in the United States in 1945, by months and States, in net tons*

[Based upon reports from producers]

State	January	February	March	April	May	June	July
Colorado	7,000	6,300	6,400	6,400	6,500	6,100	6,900
Kentucky			3,100	6,400	8,700	9,200	9,900
Pennsylvania	408,100	409,800	477,100	323,600	498,100	501,200	493,400
Utah	300	200	400	400	300	300	300
Virginia	20,700	15,700	19,600	13,600	17,000	15,600	11,600
West Virginia	24,600	24,000	28,200	26,600	29,300	28,600	28,700
	460,700	456,000	534,800	377,000	559,900	561,000	550,800

State	August	September	October	November	December	Total
Colorado	5,700	5,100	6,300	5,100	4,900	72,700
Kentucky	8,900	7,900	4,300	8,100	7,900	74,400
Pennsylvania	404,400	251,900	150,800	318,600	346,700	4,583,700
Utah	300	300	500	500	400	4,200
Virginia	11,600	15,300	18,200	16,500	15,600	191,000
West Virginia	25,500	17,300	18,000	18,900	18,200	287,900
	456,400	297,800	198,100	367,700	393,700	5,213,900

PRODUCTION BY FURNACE AND NONFURNACE PLANTS

The terms "furnace" and "nonfurnace" plants, as used in this report, apply to byproduct-coke plants only. Usually nearly all production of coke at "furnace" plants, which, as the name implies, are plants associated with iron and steel works, is consumed in blast furnaces near the ovens and does not enter the open market. For this reason, output of coke from this group of plants ordinarily follows closely the activity in the iron and steel industry; and, depending on the demand for metallurgical fuel, production tends to fluctuate more than that of "nonfurnace" plants. In 1945 production of coke at 53 furnace plants decreased 8 percent from the record output from the same number in 1944. Although production at furnace plants declined sharply in 1945, output was about 69 percent higher than the average output for the 1935–39 period and illustrated the impact of war on this group of plants.

"Nonfurnace" or "merchant" plants include several that are affiliated with local iron furnaces but produce more coke than the furnace can consume and therefore depend on the sale of foundry, domestic, and other coke; plants that sell their entire output on the competitive market; plants affiliated with alkali and chemical works; and a number of plants that were constructed to supply city gas, although not classed as public utilities, and sell their coke for domestic, industrial, and metallurgical use. Because of their diversified activities, output for this group is relatively stable, as illustrated in table 10. Production from 34 nonfurnace plants in 1945 declined only 5 percent from the 1944 figure and was only 14 percent higher than the 1935–39 prewar average.

TABLE 10.—*Number and production of byproduct-coke plants connected with iron furnaces and of other plants in the United States, 1913, 1918, 1937, and 1944–45*

Year	Number of active plants		Coke produced (net tons)		Percent of production	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
1913	20	16	9, 277, 832	3, 436, 868	73. 0	27. 0
1918	36	24	19, 220, 342	6, 777, 238	73. 9	26. 1
1937	43	42	36, 134, 209	13, 076, 539	73. 4	26. 6
1944	53	35	52, 919, 844	14, 144, 951	78. 9	21. 1
1945	53	34	48, 695, 172	13, 399, 116	78. 4	21. 6

TABLE 11.—*Monthly and average daily production of byproduct coke by plants connected with iron furnaces and by all other plants in the United States, 1937 and 1944–45, in net tons*

Month	1937		1944		1945	
	Furnace plants	Other plants	Furnace plants	Other plants	Furnace plants	Other plants
Monthly production:						
January	3, 241, 600	1, 119, 100	4, 456, 600	1, 206, 800	4, 434, 500	1, 186, 600
February	2, 996, 500	996, 400	4, 225, 800	1, 135, 000	4, 016, 300	1, 084, 700
March	3, 355, 000	1, 140, 500	4, 487, 100	1, 205, 700	4, 499, 500	1, 191, 600
April	3, 310, 300	1, 040, 600	4, 416, 400	1, 165, 300	4, 119, 100	1, 150, 100
May	3, 375, 600	1, 104, 100	4, 531, 500	1, 196, 500	4, 398, 500	1, 174, 400
June	2, 917, 500	1, 107, 300	4, 323, 400	1, 149, 400	4, 079, 400	1, 128, 100
July	3, 316, 100	1, 107, 800	4, 484, 700	1, 179, 100	4, 311, 600	1, 162, 100
August	3, 469, 300	1, 104, 100	4, 487, 500	1, 182, 800	3, 973, 100	1, 138, 200
September	3, 334, 700	1, 093, 100	4, 261, 100	1, 151, 200	3, 936, 600	1, 100, 300
October	2, 910, 500	1, 124, 600	4, 477, 900	1, 194, 000	3, 049, 400	924, 700
November	2, 142, 700	1, 079, 600	4, 338, 400	1, 168, 900	3, 793, 200	1, 034, 700
December	1, 764, 400	1, 059, 400	4, 429, 400	1, 210, 300	4, 084, 000	1, 123, 600
Total	36, 134, 200	13, 076, 600	52, 919, 800	14, 145, 000	48, 695, 200	13, 399, 100
Average daily production:						
January	104, 600	36, 100	143, 800	38, 900	143, 000	38, 300
February	107, 000	35, 600	145, 700	39, 200	143, 400	38, 800
March	108, 200	36, 800	144, 800	38, 900	145, 200	38, 400
April	110, 300	34, 700	147, 200	38, 800	137, 300	38, 300
May	108, 900	35, 600	146, 200	38, 600	141, 900	37, 900
June	97, 300	36, 900	144, 100	38, 300	136, 000	37, 600
July	107, 000	35, 700	144, 700	38, 000	139, 100	37, 500
August	111, 900	35, 600	144, 700	38, 200	128, 200	36, 700
September	111, 200	36, 400	142, 000	38, 400	131, 200	36, 700
October	93, 900	36, 300	144, 500	38, 500	98, 400	29, 800
November	71, 400	36, 000	144, 600	39, 000	126, 400	34, 500
December	56, 900	34, 200	142, 900	39, 000	131, 700	36, 300
Average	99, 000	35, 800	144, 600	38, 600	133, 400	36, 700

PRODUCTION BY STATES AND DISTRICTS

Byproduct coke.—Production of byproduct coke in 1945 declined in all but 2 of the 22 producing States, the percentage of decreases being higher in the States dominated by furnace interests. California recorded the highest relative decrease—25 percent, followed by Texas with 24 percent; Indiana, 11 percent; Pennsylvania, 10 percent; and Ohio, 9 percent. A 26-percent increase was noted in New Jersey, where new oven installations in the latter part of 1944 increased productive capacity. Tennessee showed a slight increase over 1944, with a gain of 8 percent. Notwithstanding a decline in production from 1944 of nearly 2 million tons, Pennsylvania maintained its position as the ranking coke-producing State, accounting for one-fourth of the total byproduct-coke output in 1945. Following Pennsylvania, in order of coke production, were Ohio, Indiana, New York, and Alabama. These 5 States supplied 70 percent of the total coke output, the same proportion as in 1944.

Beehive coke.—The production of beehive coke in all producing regions declined sharply in 1945. Although Pennsylvania continued its dominance in this field supplying nearly 88 percent of the total beehive-coke output in 1945, production in this State declined 26 percent from the 1944 figure and was 37 percent lower than the maximum production recorded during World War II in 1942. Production in West Virginia, the second ranking State, decreased 24 percent from 1944, and decreases of 21, 11, and 80 percent, respectively, were noted for the States of Virginia, Colorado, and Utah. Output in Kentucky, the only State recording an increase in beehive-coke production over 1944, advanced from 68,076 to 74,404 net tons, or about 9 percent.

TABLE 12.—*Byproduct and beehive coke produced in the United States, 1937 and 1942–45, by States, in net tons*

[Exclusive of screenings or breeze]

State	1937	1942	1943	1944	1945
Byproduct:					
Alabama	4, 259, 771	5, 579, 511	5, 316, 455	5, 727, 612	5, 400, 925
California			317, 847	339, 570	256, 092
Colorado	486, 945	676, 209	672, 502	650, 511	639, 099
Connecticut	(1)	(1)	(1)	(1)	(1)
Illinois	2, 998, 663	3, 690, 155	3, 625, 457	3, 878, 764	3, 681, 516
Indiana	5, 467, 061	7, 337, 512	8, 111, 916	8, 821, 021	7, 814, 247
Kentucky	(1)	(1)	(1)	(1)	(1)
Maryland	1, 513, 651	2, 103, 664	2, 059, 839	2, 058, 233	2, 024, 609
Massachusetts	1, 130, 620	1, 176, 359	1, 174, 152	1, 177, 850	1, 149, 448
Michigan	2, 283, 518	3, 139, 137	2, 948, 389	3, 005, 424	2, 805, 970
Minnesota	704, 631	955, 301	956, 396	894, 095	825, 620
Missouri	(1)	(1)	(1)	(1)	(1)
New Jersey	1, 015, 073	1, 038, 461	1, 014, 268	1, 022, 917	1, 284, 020
New York	4, 946, 964	5, 180, 384	5, 347, 369	6, 102, 560	5, 789, 974
Ohio	6, 737, 881	9, 912, 783	10, 270, 758	10, 338, 913	9, 405, 710
Pennsylvania	13, 701, 262	16, 310, 167	16, 518, 872	16, 976, 574	15, 255, 137
Rhode Island	(1)	(1)	(1)	(1)	(1)
Tennessee	89, 451	234, 529	254, 211	219, 503	236, 979
Texas				184, 506	140, 254
Utah	149, 659	242, 531	240, 736	739, 432	731, 306
Washington	14, 656		14, 853		
West Virginia	1, 817, 993	2, 444, 368	2, 611, 825	2, 637, 591	2, 462, 477
Wisconsin	(1)	(1)	(1)	(1)	(1)
Combined States	1, 892, 949	2, 273, 838	2, 286, 831	2, 289, 719	2, 190, 905
	49, 210, 748	62, 294, 909	63, 742, 676	67, 064, 795	62, 094, 288
Beehive:					
Alabama		95, 428	34, 674		
Colorado	64, 222	87, 447	85, 141	81, 684	72, 678
Kentucky		1, 138	29, 298	68, 076	74, 404
Pennsylvania	2, 559, 048	7, 309, 337	6, 934, 445	6, 170, 897	4, 583, 720
Tennessee	14, 982	72, 541	48, 861	8, 850	
Utah	6, 657	22, 402	84, 093	21, 442	4, 205
Virginia	240, 425	350, 521	293, 324	243, 116	191, 032
West Virginia	279, 387	335, 221	423, 551	378, 957	287, 854
	3, 164, 721	8, 274, 035	7, 933, 387	6, 973, 022	5, 213, 893
Grand total	52, 375, 469	70, 568, 944	71, 676, 063	74, 037, 817	67, 308, 181

[1] Included under "Combined States."

TABLE 13.—*Coke produced, value, number of ovens, coal charged, and average yield in the United States in 1945, by States*

[Exclusive of screenings or breeze]

State	Byproduct						
	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens	
						Total	Per ton
Alabama	7	1,490	7,541,430	71.62	5,400,925	$33,448,229	$6.19
California	1	90	439,497	58.27	256,092	(1)	(1)
Colorado	1	188	980,460	65.18	639,099	(1)	(1)
Illinois	9	882	5,197,860	70.83	3,681,516	32,377,629	8.79
Indiana	5	1,816	10,634,056	73.48	7,814,247	68,458,007	8.76
Maryland	1	422	2,767,471	73.16	2,024,609	(1)	(1)
Massachusetts	2	215	1,622,328	70.85	1,149,448	(1)	(1)
Michigan	[2] 5	568	3,928,922	71.42	2,805,970	24,119,361	8.60
Minnesota	3	196	1,157,426	71.33	825,620	7,760,362	9.40
New Jersey	2	280	1,801,096	71.29	1,284,020	(1)	(1)
New York	8	1,142	8,224,361	70.40	5,789,974	46,676,238	8.06
Ohio	15	2,099	13,199,416	71.26	9,405,710	70,381,885	7.48
Pennsylvania	13	3,625	21,750,174	70.14	15,255,137	98,161,908	6.43
Tennessee	1	44	318,796	74.34	236,979	(1)	(1)
Texas	[3] 1	125	201,658	69.55	140,254	(1)	(1)
Utah	2	308	1,275,656	57.33	731,306	(1)	(1)
West Virginia	[4] 5	506	3,513,156	70.09	2,462,477	11,939,470	4.85
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	514	2,983,001	73.45	2,190,905	19,840,493	9.06
Undistributed						57,026,757	8.83
Total: 1945	87	14,510	87,536,764	70.94	62,094,288	470,190,339	7.57
1944	88	14,580	94,437,887	71.01	67,064,795	478,844,172	7.14

State	Beehive						Total	
	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens		Coke produced (net tons)	Value of coke at ovens
					Total	Per ton		
Alabama							5,400,925	$33,448,229
California							256,092	(1)
Colorado	160	111,884	64.96	72,678	(1)	(1)	711,777	(1)
Illinois							3,681,516	32,377,629
Indiana							7,814,247	68,458,007
Maryland							2,024,609	(1)
Massachusetts							1,149,448	(1)
Michigan							2,805,970	24,119,361
Minnesota							825,620	7,760,362
New Jersey							1,284,020	(1)
New York							5,789,974	46,676,238
Ohio							9,405,710	70,381,885
Pennyslvania	9,969	7,111,401	64.46	4,583,720	$33,233,516	$7.25	19,838,857	131,395,424
Tennessee							236,979	(1)
Texas							140,254	(1)
Utah	297	7,945	52.93	4,205	(1)	(1)	735,511	(1)
Virginia	749	325,184	58.75	191,032	1,541,650	8.07	191,032	1,541,650
West Virginia	813	459,550	62.64	287,854	2,228,115	7.74	2,750,331	14,167,585
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	191	118,665	62.70	74,404	(1)	(1)	2,265,309	(1)
Undistributed					1,346,422	8.90		78,213,672
Total: 1945	12,179	8,134,629	64.10	5,213,893	38,349,703	7.36	67,308,181	508,540,042
1944	16,318	10,858,435	64.22	6,973,022	49,077,334	7.04	74,037,817	527,921,506

[1] Included under "Undistributed."
[2] *1 plant operated through July only.*
[3] Operated through October only.
[4] 1 plant operated through August only.

TABLE 14.—*Byproduct coke produced in the United States in 1945, by geographical districts in the iron and steel industry*

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens: Total	Value of coke at ovens: Per ton
Eastern	22	3,424	22,329,862	71.06	15,868,307	$134,102,688	$8.45
Pittsburgh-Youngstown	16	3,707	23,499,753	70.15	16,484,795	99,157,330	6.02
Cleveland-Detroit	11	1,475	9,293,492	71.89	6,680,803	55,585,044	8.32
Chicago	20	3,153	18,143,004	72.72	13,193,251	117,566,411	8.91
Southern	14	2,165	11,575,040	71.19	8,240,635	48,614,106	5.90
Western	4	586	2,695,613	60.34	1,626,497	15,164,760	9.32
	87	14,510	87,536,764	70.94	62,094,288	470,190,339	7.57

TABLE 15.—*Byproduct and beehive coke produced in Pennsylvania in 1945, by districts*

District	Plants	Ovens	Coal charged (net tons)	Yield of coke from coal (percent)	Coke produced (net tons)	Value of coke at ovens: Total	Value of coke at ovens: Per ton
Byproduct:							
Eastern Pennsylvania [1]	5	796	4,287,671	71.37	3,060,241	$27,062,335	$8.84
Western Pennsylvania [2]	8	2,829	17,462,503	69.83	12,194,896	71,099,573	5.83
	13	3,625	21,750,174	70.14	15,255,137	98,161,908	6.43
Beehive:							
Fayette County	38	7,803	5,247,144	64.45	3,381,835	24,125,299	7.13
Westmoreland County	14	1,562	1,292,496	65.13	841,813	6,328,897	7.52
Other Counties [3]	4	604	571,761	62.98	360,072	2,779,320	7.72
	56	9,969	7,111,401	64.46	4,583,720	33,233,516	7.25
Grand total	69	13,594	28,861,575	68.74	19,838,857	131,395,424	6.62

[1] Includes plants at Bethlehem, Chester, Philadelphia, Steelton, and Swedeland.
[2] Includes plants at Aliquippa, Clairton, Erie, Johnstown, Midland, Monessen, Neville Island, and Pittsburgh.
[3] Comprised of figures from 1 plant each in Beaver, Cambria, Greene, and Indiana Counties.

NUMBER AND TYPE OF OVENS

Byproduct ovens.—The wartime expansion in byproduct-coking capacity that reached a peak in 1943 when 953 new byproduct-coke ovens were completed subsided sharply in 1945, when only 106 new ovens were placed in operation in December 1945, by the Jones & Laughlin Steel Corp. at its Aliquippa, Pa., steel plant. Information received by the Bureau of Mines from coke producers indicated that 335 new ovens with an annual coke capacity of 1,414,000 tons were under construction on December 31. Because the unprecedented demands for metallurgical and industrial coke during the war period made it necessary for all active plants to operate at maximum productive capacity, deterioration and oven failure, particularly among the older batteries, increased, and in December 516 ovens were idle at active plants. A recapitulation of all byproduct ovens in existence at the end of 1945 revealed that 8 percent of all ovens were more than 30 years old, 42 percent more than 20 years old, 21 percent more than 10 years old, and 29 percent 10 years old or less. As it has been generally agreed that the average life of a byproduct-coke oven is about 20 years, extensive repairs and rebuilding will be necessary, unless new ovens are constructed, to maintain adequate capacity to meet future requirements of coke.

Beehive ovens.—The effect of war-contract cancellations following VE-day and later VJ-day and other economic factors already referred to in this report is reflected in the number of beehive ovens shut down or permanently abandoned in 1945. Of the 16,318 ovens in existence on January 1, 1945, 4,505 were dismantled or permanently abandoned during the year, and at the end of the year only 12,179 were reported in existence. The average number of beehive ovens in blast during the year varied from a high of 10,281 in July to a low of 7,518 in October, when mine stoppages hampered the flow of coal to the ovens. In December the active ovens numbered 8,317, and the large requirements for metallurgical coke in the reconversion program indicate that the number of beehive ovens that will operate in 1946 will vary only slightly from this total.

TABLE 16.—*Coke ovens completed and abandoned in the United States in 1945 and total number in existence at end of year, by States*

State	Plants in existence Dec. 31	Ovens: In existence Dec. 31: Number	Ovens: In existence Dec. 31: Annual capacity (net tons of coke)	Ovens: New: Number	Ovens: New: Annual capacity (net tons of coke)	Ovens: Abandoned during year	Ovens: Under construction Dec. 31: Number	Ovens: Under construction Dec. 31: Annual capacity (net tons of coke)
Byproduct:								
Alabama	8	[1] 1,490	6,635,200					
California	1	90	340,000					
Colorado	1	188	813,000				[2] 74	327,000
Connecticut	1	70	(3)					
Illinois	9	882	4,004,500			110		
Indiana	5	1,816	9,197,800			40	47	144,000
Kentucky	1	120	(3)					
Maryland	1	422	2,124,000					
Massachusetts	2	215	1,289,800					
Michigan	4	[4] 568	2,912,600			18		
Minnesota	3	196	985,600					
Missouri	1	64	(3)					
New Jersey	2	280	1,327,000			8	37	143,000
New York	8	1,142	6,236,000					
Ohio	15	2,099	10,228,300				177	800,000
Pennsylvania	13	3,625	18,171,200	106	708,000			
Rhode Island	1	65	(3)					
Tennessee	1	44	242,000					
Texas	2	[5] 125	706,000					
Utah	2	308	1,202,800					
West Virginia	5	[6] 506	2,682,500					
Wisconsin	2	195	(3)					
Undistributed			2,300,800					
	88	14,510	71,399,100	106	708,000	176	335	1,414,000
At merchant plants	34	3,234	14,679,600			66	84	287,000
At furnace plants	54	11,276	56,719,500	106	708,000	110	251	1,127,000
Beehive:								
Colorado	1	160	80,000			100		
Kentucky	1	191	172,000			9		
Pennsylvania	50	9,969	6,901,350	52	28,600	3,400		
Tennessee						240		
Utah	1	297	147,000			500		
Virginia	5	749	382,800			4		
West Virginia	6	813	411,700			252		
	64	12,179	8,094,850	52	28,600	4,505		

[1] 240 ovens idle entire year.
[2] Completed but idle.
[3] Included under "Undistributed."
[4] 18 ovens abandoned in August.
[5] 78 ovens idle entire year and 47 ovens idle since October.
[6] 74 ovens idle since August 15.

TABLE 17.—*Average number of beehive ovens active in the United States in 1945, by months*

Month	Number	Month	Number	Month	Number
January	9,373	May	10,274	September	8,242
February	9,703	June	10,211	October	7,518
March	9,910	July	10,281	November	7,613
April	9,927	August	9,897	December	8,317

CAPACITY OF BYPRODUCT-COKE PLANTS

Tables 18 and 19 show the potential maximum annual coke capacity of all byproduct ovens in existence, whether idle or active, and the relationship between capacity and production for 1937 and 1942–45. The basis upon which potential maximum capacity of a coke plant is established is the minimum coking time at which the ovens can be operated to produce coke with qualities suitable for the use for which it is intended. The operators are requested to report the potential maximum annual coke capacity of their ovens "of grades you aim to produce, that can be obtained with all conditions favorable and all ovens active." Potential maximum annual coke capacity, as thus stated, is subject to change from year to year, depending on the age and condition of the ovens, character and quality of coal charged, and economic and labor conditions.

The annual capacity of the 88 byproduct-coke plants in existence on December 31, 1945, both idle and active, decreased 1 percent from the 1944 figure (table 18). The annual capacity of "furnace" plants was 56,719,500 tons, a slight decrease from 1944, but an increase of 21 percent over the 1937 capacity. "Merchant" or nonfurnace plants ended the year with an annual capacity of 14,679,600 tons, compared with 15,344,700 tons in 1944. The operating ratio in 1945 showed an appreciable drop, especially after termination of the war in August, and for the year was 84.3 percent of capacity compared with 93.1 percent in 1944 (table 19).

TABLE 18.—*Potential maximum annual coke capacity of all byproduct-coke plants in existence in the United States, 1937 and 1942–45*

Year	Plants	Ovens	Potential maximum annual coke capacity (net tons)	Percent of change from 1937
1937	87	12,718	62,727,075	
1942	88	13,303	64,554,972	+2.9
1943	92	14,253	71,378,408	+13.8
1944	89	14,580	72,330,200	+15.3
1945	88	14,510	71,399,100	+13.8

TABLE 19.—*Relationship of production to potential maximum capacity [1] at byproduct-coke plants in the United States, 1937 and 1942–45, by months, in percent*

Month	1937	1942	1943	1944	1945	Month	1937	1942	1943	1944	1945
January	83.0	94.3	98.7	95.8	89.1	August	86.0	98.0	96.3	91.1	82.4
February	83.5	94.2	98.8	96.6	89.6	September	86.1	98.4	96.7	89.8	84.0
March	84.9	94.3	98.0	95.7	90.2	October	76.0	98.4	94.7	91.1	64.1
April	84.9	94.3	98.0	96.2	86.3	November	62.8	98.9	90.7	90.8	80.5
May	84.6	98.1	96.4	95.5	88.4	December	53.1	98.4	94.2	89.7	83.2
June	78.6	98.3	92.6	94.3	85.3						
July	83.2	97.6	93.3	91.5	88.3	The year	78.8	96.9	95.7	93.1	84.3

[1] Capacity of all ovens in existence, whether active or idle, based upon maximum daily capacity times days in month.

QUANTITY AND COST OF COAL CHARGED

Tables 20 and 21 show the quantity and cost of coal charged into byproduct and beehive ovens, by months and by States, in 1945. The total quantity charged into byproduct ovens decreased 7 percent in 1945 from 1944, and for beehive ovens the decline was 25 percent. Although some slackening in the monthly consumption of coking coal was evident before VJ-day, the average rate for the first 7 months was only slightly less than for the peak in 1944. However, with the end of the war in the Pacific and subsequent labor difficulties and reconversion problems, average monthly consumption declined from 8.4 million tons for the first 7 months to 7.3 million tons for the last 5 months.

Pennsylvania's position as the leading consumer of coking coal remained unchallenged, carbonizing nearly 25 percent of all byproduct coal and more than 87 percent of the total used in beehive coking. Byproduct ovens in Ohio consumed 15 percent of the total, all of which was shipped from adjoining States; Indiana consumed 12 percent and New York and Alabama 9 percent each.

The average cost of coking coal per ton at byproduct- and beehive-coke plants advanced 4 and 6 percent, respectively, in 1945 over 1944. These increases were caused largely by the wage adjustments granted to bituminous-coal miners in the agreement concluded in April 1945. For individual States where figures can be shown, the greatest increases in the cost of coal charged into byproduct ovens were recorded in Alabama, with a gain of $0.44 per ton, followed by Ohio and West Virginia with $0.24 each, Minnesota $0.17, and Michigan and New York $0.16 each. For States producing beehive coke, the highest rise in coal costs was registered in Pennsylvania, with an increase of $0.21 per ton. The average cost of coal per ton for beehive ovens is much less than that for byproduct ovens, as the former are built at or near the producing mines and therefore benefit from the saving in transportation charges.

TABLE 20.—*Coal consumed in coke ovens in the United States, 1937 and 1944–45, by months, in net tons*

Month	1937			1944			1945		
	Byproduct	Beehive	Total	Byproduct	Beehive	Total	Byproduct	Beehive	Total
January	6, 198, 700	426, 600	6, 625, 300	7, 969, 300	1, 064, 400	9, 033, 700	7, 913, 800	717, 600	8, 631, 400
February	5, 679, 900	458, 500	6, 138, 400	7, 534, 000	1, 006, 500	8, 540, 500	7, 196, 200	711, 600	7, 907, 800
March	6, 387, 000	556, 800	6, 943, 800	8, 071, 100	1, 041, 400	9, 112, 500	8, 045, 700	832, 300	8, 878, 000
April	6, 183, 800	480, 800	6, 664, 600	7, 885, 500	957, 000	8, 842, 500	7, 447, 800	591, 000	8, 038, 800
May	6, 368, 500	509, 700	6, 878, 200	8, 089, 000	1, 001, 600	9, 090, 600	7, 858, 800	871, 300	8, 730, 100
June	5, 729, 200	430, 500	6, 159, 700	7, 728, 600	954, 000	8, 682, 600	7, 335, 200	873, 500	8, 208, 700
July	6, 217, 200	441, 700	6, 658, 900	7, 949, 100	940, 000	8, 889, 100	7, 687, 400	856, 700	8, 544, 100
August	6, 425, 800	401, 100	6, 826, 900	7, 960, 200	891, 400	8, 851, 600	7, 176, 900	711, 200	7, 888, 100
September	6, 220, 700	392, 800	6, 613, 500	7, 588, 400	800, 900	8, 389, 300	7, 123, 600	466, 800	7, 590, 400
October	5, 664, 800	351, 600	6, 016, 400	7, 966, 800	817, 700	8, 784, 500	5, 616, 500	313, 700	5, 930, 200
November	4, 527, 000	264, 000	4, 791, 000	7, 730, 600	754, 600	8, 485, 200	6, 795, 400	574, 400	7, 369, 800
December	3, 972, 800	212, 700	4, 185, 500	7, 965, 300	628, 900	8, 594, 200	7, 339, 500	614, 500	7, 954, 000
	69,575,400	4, 926, 800	74, 502, 200	94, 437, 900	10, 858, 400	105,296,300	87, 536, 800	8, 134, 600	95, 671, 400

TABLE 21.—*Total quantity and value at ovens of coal used in manufacturing coke in the United States in 1945, by States*

State	Coal used (net tons)	Cost of coal		Coal per ton of coke	
		Total	Average	Net tons	Cost
Byproduct:					
Alabama	7, 541, 430	$33, 680, 762	$4. 47	1. 40	$6. 26
California	439, 497	(1)	(1)	1. 72	(1)
Colorado	980, 460	(1)	(1)	1. 53	(1)
Illinois	5, 197, 860	32, 034, 217	6. 16	1. 41	8. 69
Indiana	10, 634, 056	66, 238, 174	6. 23	1. 36	8. 47
Maryland	2, 767, 471	(1)	(1)	1. 37	(1)
Massachusetts	1, 622, 328	(1)	(1)	1. 41	(1)
Michigan	3, 928, 922	21, 789, 352	5. 55	1. 40	7. 77
Minnesota	1, 157, 426	7, 548, 519	6. 52	1. 40	9. 13
New Jersey	1, 801, 096	(1)	(1)	1. 40	(1)
New York	8, 224, 361	49, 684, 071	6. 04	1. 42	8. 58
Ohio	13, 199, 416	69, 553, 535	5. 27	1. 40	7. 38
Pennsylvania	21, 750, 174	95, 807, 194	4. 40	1. 43	6. 29
Tennessee	318, 796	(1)	(1)	1. 35	(1)
Texas	201, 658	(1)	(1)	1. 44	(1)
Utah	1, 275, 656	(1)	(1)	1. 74	(1)
West Virginia	3, 513, 156	12, 522, 020	3. 56	1. 43	5. 09
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2, 983, 001	17, 749, 446	5. 95	1. 36	8. 09
Undistributed		55, 887, 785	5. 94	1. 46	8. 67
	87, 536, 764	462, 495, 075	5. 28	1. 41	7. 45
At merchant plants	18, 744, 286	110, 549, 445	5. 90	1. 40	8. 26
At furnace plants	68, 792, 478	351, 945, 630	5. 12	1. 41	7. 22
Beehive:					
Colorado	111, 884	(1)	(1)	1. 54	(1)
Kentucky	118, 665	(1)	(1)	1. 59	(1)
Pennsylvania	7, 111, 401	24, 943, 962	3. 51	1. 55	5. 44
Utah	7, 945	(1)	(1)	1. 89	(1)
Virginia	325, 184	1, 005, 835	3. 09	1. 70	5. 25
West Virginia	459, 550	1, 557, 732	3. 39	1. 60	5. 42
Undistributed		1, 058, 569	4. 44	1. 58	7. 02
	8, 134, 629	28, 566, 098	3. 51	1. 56	5. 48

[1] Included under "Undistributed."

TABLE 22.—*Average cost per net ton of coal charged into byproduct-coke ovens in the United States, 1937 and 1942–45, by States*

State	1937	1942	1943	1944	1945
Alabama	$2.33	$3.13	$3.60	$4.03	$4.47
Illinois	4.62	5.28	5.62	6.04	6.16
Indiana	4.71	5.50	5.85	6.11	6.23
Michigan	4.16	4.87	4.57	5.39	5.55
Minnesota	5.24	5.64	6.02	6.35	6.52
New York	4.55	5.37	5.59	5.88	6.04
Ohio	3.76	4.41	4.73	5.03	5.27
Pennsylvania	2.98	3.44	3.96	4.28	4.40
West Virginia	2.54	2.92	3.19	3.32	3.56
All other States [1]	4.53	5.26	5.59	5.72	5.94
United States average	3.74	4.38	4.75	5.08	5.28
Cost of coal per ton of coke	5.27	6.18	6.70	7.16	7.45

[1] Includes California, Colorado, Connecticut, Kentucky, Maryland, Massachusetts, Missouri, New Jersey, Rhode Island, Tennessee, Texas, Utah, and Wisconsin.

TABLE 23.—*Cost of coal and value of all products per net ton of coke produced in the United States, 1918, 1929, and 1937–45*

Year	Byproduct				Beehive	
	Cost of coal per ton of coke	Value per ton of coke produced			Cost of coal per ton of coke	Value of coke per ton
		Coke	Byproducts	Total		
1918	$6.00	$7.42	$3.08	$10.50	$3.65	$6.21
1929	5.04	4.80	3.56	8.36	2.85	3.49
1937	5.27	5.03	2.97	8.00	3.14	4.31
1938	5.61	5.16	3.53	8.69	3.32	4.42
1939	5.36	4.81	3.19	8.01	3.16	4.45
1940	5.23	4.82	2.99	7.81	3.12	4.41
1941	5.53	5.41	2.98	8.39	3.66	5.44
1942	6.18	6.07	3.10	9.17	3.93	5.75
1943	6.70	6.65	3.13	9.78	4.77	6.55
1944	7.16	7.14	3.10	10.24	5.15	7.04
1945	7.45	7.57	3.07	10.64	5.48	7.36

PREPARATION AND SOURCE OF COAL

Washed and unwashed coal.—Table 24 shows the quantity of washed and unwashed coal used in the manufacture of coke in 1945. When the coals used in the manufacture of coke contain an undue proportion of ash, sulfur, or other impurities, they are usually cleaned before being charged into coke ovens. Although the reduction of these incidental impurities by cleaning is by no means a normal adjunct to coking operations, more attention is being given to the cleaning of coal because of the rapid depletion of high-quality coking coals. Cleaning of coal to reduce its ash and sulfur content has been practiced by coke producers (according to available data) since 1890, when but 7 percent was washed. In 1945, the quantity of washed coal used in the manufacture of coke was equivalent to 27 percent of the total quantity carbonized, the same proportion as in 1944. Coal cleaned at the mines was used by 32 byproduct- and 12 beehive-coke plants in 1945, and in addition 6 byproduct-coke plants carbonized coal that was cleaned in cleaning plants near the ovens. All coal used for the manufacture of coke in Colorado and most of that in Alabama, California, Tennessee, and Texas was washed.

TABLE 24.—*Washed and unwashed coal used in manufacturing coke in the United States in 1945, by States in which used, in net tons*

State	Byproduct				Beehive		
	Bituminous		Anthracite	Total	Bituminous		
	Washed	Unwashed			Washed	Unwashed	Total
Alabama	7,374,386	167,044		7,541,430			
California	392,231	47,266		439,497			
Colorado	980,460			980,460	111,884		111,884
Illinois	1,127,070	4,037,742	33,048	5,197,860			
Indiana	29,202	10,604,854		10,634,056			
Maryland		2,767,471		2,767,471			
Massachusetts		1,622,328		1,622,328			
Michigan	233,511	3,593,209	102,202	3,928,922			
Minnesota		1,157,426		1,157,426			
New Jersey		1,801,096		1,801,096			
New York	830,742	7,345,376	48,243	8,224,361			
Ohio	3,245,699	9,949,738	3,979	13,199,416			
Pennsylvania	8,640,198	12,999,187	110,789	21,750,174	1,001,995	6,109,406	7,111,401
Tennessee	229,533	89,263		318,796			
Texas	192,956	8,702		201,658			
Utah		1,275,656		1,275,656		7,945	7,945
Virginia						325,184	325,184
West Virginia	1,287,347	2,220,822	4,987	3,513,156		459,550	459,550
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin		2,963,648	19,353	2,983,001		118,665	118,665
	24,563,335	62,650,828	322,601	87,536,764	1,113,879	7,020,750	8,134,629
At merchant plants	1,515,898	17,159,304	69,084	18,744,286			
At furnace plants	23,047,437	45,491,524	253,517	68,792,478			

Sources.—In recent years more and more emphasis has been placed on the sources of high-grade coals of established coking quality in the United States because of their irregular and limited distribution and also because of the rapid rate at which our reserves of such coals are being depleted.[11] Almost any kind of clean coal can be used for ordinary fuel, but the coke industry undoubtedly has the most stringent standards of all major consuming industries, and coals used in the manufacture of coke must be carefully selected.

Coal fields in the Appalachian region, extending from Alabama to Pennsylvania, are the principal sources of coking coal in the United States and in 1945 supplied over 96 percent of all coal carbonized. The ranking States, in tonnage of coal furnished to byproduct-coke plants in 1945, were Pennsylvania, supplying 37 percent, West Virginia 35 percent, Kentucky 13 percent, and Alabama 9 percent. Other States supplying more than a million tons of byproduct coal in 1945 were Virginia and Utah. Of the 87,128,174 tons of coal purchased by coke-oven operators in 1945, more than 61 percent was received from captive mines.

[11] Potter, C. J., Fuel and Power, Dec. 10, 1945.

TABLE 25.—*Coal purchased for manufacturing byproduct coke in the United States in 1945, by fields of origin, in net tons*

State and district where coal produced	Total purchased	States where coal consumed—in order of importance
Alabama	7,433,968	Alabama.
Arkansas	55,201	California, Colorado, Illinois, and Utah.
Colorado	820,131	Colorado and Utah.
Illinois	283,022	Illinois and Minnesota.
Indiana	81,378	Illinois, Wisconsin, and Indiana.
Kentucky:		
Elkhorn	3,798,872	Indiana, Ohio, Illinois, New York, New Jersey, Pennsylvania, Michigan, Minnesota, Massachusetts, Wisconsin, and Kentucky.
Harlan	5,211,185	Indiana, Ohio, Illinois, Minnesota, Pennsylvania, Tennessee, and New York.
Kenova-Thacker	1,713,068	Michigan, Ohio, Wisconsin, Pennsylvania, New York, and Connecticut.
Miscellaneous	498,251	Illinois.
New Mexico	292,727	Colorado.
Oklahoma	191,569	Texas.
Pennsylvania:		
Anthracite	330,809	Michigan, Pennsylvania, New York, Illinois, Missouri, West Virginia, and Wisconsin.
Butler-Mercer	9,223	Ohio and Illinois.
Central Pennsylvania:		
High-volatile	840,462	New York.
Medium-volatile	814,573	New York, Maryland, and Pennsylvania.
Low-volatile	2,648,735	Pennsylvania, Ohio, and New York.
Connellsville	13,488,583	Pennsylvania, Ohio, West Virginia, Illinois, New York, Indiana, Minnesota, Connecticut, and New Jersey.
Freeport	2,087,557	Ohio, West Virginia, Michigan, Pennsylvania, and New York.
Pittsburgh	10,440,780	Pennsylvania, New York, Ohio, Michigan, Wisconsin, and Indiana.
Somerset	464,095	Pennsylvania, West Virginia, and New York.
Westmoreland	1,343,146	Pennsylvania, Maryland, Ohio, and New Jersey.
Tennessee	213,081	Tennessee and Ohio.
Utah	1,651,124	Utah and California.
Virginia:		
Pocahontas	913,117	Indiana, New York, and Tennessee.
Southwestern	948,957	Michigan, Ohio, New Jersey, New York, Massachusetts, Indiana, Connecticut, and Pennsylvania.
West Virginia:		
Coal and Coke	7,690	Pennsylvania.
Coal River	543	Ohio.
Kanawha	6,381,605	Ohio, Illinois, Kentucky, West Virginia, Massachusetts Indiana, Wisconsin, New Jersey, Connecticut, Pennsylvania, Missouri, Minnesota, Rhode Island, Michigan New York, and Maryland.
Kenova-Thacker	145,141	Massachusetts, Ohio, Connecticut, and New York.
Logan	3,025,625	Ohio, Indiana, New Jersey, Michigan, Pennsylvania, New York, Massachusetts, Connecticut, Illinois, and Minnesota.
New River:		
High-volatile	983,839	New York, New Jersey, Illinois, Michigan, and Pennsylvania.
Medium-volatile	901,720	Maryland, Massachusetts, Ohio, Michigan, and New York.
Low-volatile	201,561	Rhode Island, Massachusetts, and Minnesota.
Northern	4,586,738	Maryland, Pennsylvania, West Virginia, Michigan, New York, Ohio, and Illinois.
Pocahontas	11,841,094	Indiana, Ohio, Illinois, Michigan, New York, Maryland, Pennsylvania, Minnesota, Wisconsin, Kentucky, Connecticut, Alabama, Missouri, Rhode Island, and West Virginia.
Tug River	39,447	New York and Rhode Island.
Webster-Gauley	1,290,605	Pennsylvania, New York, Ohio, Maryland, Massachusetts, Wisconsin, New Jersey, and Connecticut.
Winding Gulf	1,148,952	New Jersey, Massachusetts, New York, Michigan, Rhode Island, West Virginia, Illinois, Pennsylvania, and Kentucky.
	87,128,174	

TABLE 26.—*Coal purchased for manufacturing byproduct coke in the United States in 1945, by States where produced and where consumed and by merchant and furnace plants, in net tons*

State where coal consumed	Coal produced in—													
	Alabama	Arkansas	Colorado	Illinois	Indiana	Kentucky	New Mexico	Oklahoma	Pennsylvania	Tennessee	Utah	Virginia	West Virginia	Total
Alabama:														
Merchant plants	1,066,337												121,021	1,187,358
Furnace plants	6,367,631												8,243	6,375,874
Total Alabama	7,433,968												129,264	7,563,232
California: Furnace plant		44,673									379,562			424,235
Colorado: Furnace plant		7,958	820,087				292,727							1,120,772
Illinois:														
Merchant plants				6,000		59,231			23,891				757,346	846,468
Furnace plants		2,401		240,304	50,990	1,732,602			413,655				1,960,685	4,400,637
Total Illinois		2,401		246,304	50,990	1,791,833			437,546				2,718,031	5,247,105
Indiana:														
Merchant plants												69,977	801,354	871,331
Furnace plants					15,027	4,746,706			50,933			806,576	3,977,111	9,596,353
Total Indiana					15,027	4,746,706			50,933			876,553	4,778,465	10,467,684
Maryland: Furnace plant									114,932				2,487,415	2,602,347
Massachusetts: Merchant plants						21,217						118,867	1,478,637	1,618,721
Michigan:														
Merchant plants									267,219			187,281	564,308	1,018,808
Furnace plants						1,353,080			298,646			96,385	1,105,129	2,853,240
Total Michigan						1,353,080			565,865			283,666	1,669,437	3,872,048
Minnesota:														
Merchant plant				36,718		65,629							312,868	415,215
Furnace plants						401,853			26,467				260,606	688,926
Total Minnesota				36,718		467,482			26,467				573,474	1,104,141
New Jersey: Merchant plants						138,225			7,518			169,214	1,389,549	1,704,506
New York:														
Merchant plants						361,229			1,735,206			124,230	1,811,470	4,032,135
Furnace plants						32,098			3,156,191			83,299	781,801	4,053,389
Total New York						393,327			4,891,397			207,529	2,593,271	8,085,524

Ohio:														
Merchant plants						90,314						170,055	1,368,801	1,629,170
Furnace plants						1,791,683			5,365,970	6,980			4,300,146	11,464,779
Total Ohio						1,881,997			5,365,970	6,980		170,055	5,668,947	13,093,949
Pennsylvania:														
Merchant plants									108,031				732,660	840,691
Furnace plants						219,504			18,588,504			980	2,350,378	21,159,366
Total Pennsylvania						219,504			18,696,535			980	3,083,038	22,000,057
Tennessee: Furnace plant						90,261				206,101		28,602		324,964
Texas: Furnace plant								191,569						191,569
Utah: Furnace plants		169	44								1,271,562			1,271,775
West Virginia:														
Merchant plants									5,807				1,286,290	1,292,097
Furnace plants									2,250,336				1,355	2,251,691
Total West Virginia									2,256,143				1,287,645	3,543,788
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants					15,361	117,744			54,657			6,608	2,697,387	2,891,757
	7,433,968	55,201	820,131	283,022	81,378	11,221,376	292,727	191,569	32,467,963	213,081	1,651,124	1,862,074	30,554,560	87,128,174
At merchant plants	1,066,337			42,718	15,361	853,589			2,202,329			846,232	13,321,691	18,348,257
At furnace plants	6,367,631	55,201	820,131	240,304	66,017	10,367,787	292,727	191,569	30,265,634	213,081	1,651,124	1,015,842	17,232,869	68,779,917

TABLE 27.—*Coal purchased for manufacturing byproduct coke in the United States in 1945, by States where consumed and by volatile content* [1]

State where coal consumed	Low-volatile		Medium-volatile		High-volatile		Total coal purchased (net tons)
	Net tons	Percent of total	Net tons	Percent of total	Net tons	Percent of total	
Alabama:							
Merchant plants	121, 021	10. 2	618, 092	52. 0	448, 245	37. 8	1, 187, 358
Furnace plants	8, 243	. 1	6, 058, 143	95. 0	309, 488	4. 9	6, 375, 874
Total Alabama	129, 264	1. 7	6, 676, 235	88. 3	757, 733	10. 0	7, 563, 232
California: Furnace plant	44, 673	10. 5			379, 562	89. 5	424, 235
Colorado: Furnace plant	7, 958	. 7	706, 533	63. 0	406, 281	36. 3	1, 120, 772
Illinois:							
Merchant plants	271, 382	32. 1	367, 468	43. 4	207, 618	24. 5	846, 468
Furnace plants	1, 465, 802	33. 3	4, 598	. 1	2, 930, 237	66. 6	4, 400, 637
Total Illinois	1, 737, 184	33. 1	372, 066	7. 1	3, 137, 855	59. 8	5, 247, 105
Indiana:							
Merchant plants	350, 619	40. 2	103, 687	11. 9	417, 025	47. 9	871, 331
Furnace plants	4, 137, 014	43. 1			5, 459, 339	56. 9	9, 596, 353
Total Indiana	4, 487, 633	42. 9	103, 687	1. 0	5, 876, 364	56. 1	10, 467, 684
Maryland: Furnace plant	480, 779	18. 5	447, 891	17. 2	1, 673, 677	64. 3	2, 602, 347
Massachusetts: Merchant plants	325, 429	20. 1	350, 886	21. 7	942, 406	58. 2	1, 618, 721
Michigan:							
Merchant plants	344, 786	33. 8	78, 571	7. 7	595, 451	58. 5	1, 018, 808
Furnace plants	563, 971	19. 8			2, 289, 269	80. 2	2, 853, 240
Total Michigan	908, 757	23. 5	78, 571	2. 0	2, 884, 720	74. 5	3, 872, 048
Minnesota:							
Merchant plant	102. 921	24. 8	19, 066	4. 6	293, 228	70. 6	415, 215
Furnace plants	260, 606	37. 8			428, 320	62. 2	688, 926
Total Minnesota	363, 527	32. 9	19, 066	1. 7	721, 548	65. 4	1, 104, 141
New Jersey: Merchant plants	363, 285	21. 3	586, 849	34. 4	754, 372	44. 3	1, 704, 506
New York:							
Merchant plants	460, 805	11. 4	380, 653	9. 5	3, 190, 677	79. 1	4, 032, 135
Furnace plants	778, 120	19. 2	791, 362	19. 5	2, 483, 907	61. 3	4, 053, 389
Total New York	1, 238, 925	15. 3	1, 172, 015	14. 5	5, 674, 584	70. 2	8, 085, 524
Ohio:							
Merchant plants	550, 543	33. 8	136, 338	8. 4	942, 289	57. 8	1, 629, 170
Furnace plants	3, 101, 003	27. 1	552, 548	4. 8	7, 811, 228	68. 1	11, 464, 779
Total Ohio	3, 651, 546	27. 9	688, 886	5. 3	8, 753, 517	66. 8	13, 093, 949
Pennsylvania:							
Merchant plants	118, 282	14. 1	359, 331	42. 7	363, 078	43. 2	840, 691
Furnace plants	2, 791, 081	13. 2	264, 673	1. 3	18,103,612	85. 5	21, 159, 366
Total Pennsylvania	2, 909, 363	13. 2	624, 004	2. 8	18,466,690	84. 0	22, 000, 057
Tennessee: Furnace plant	28, 602	8. 8	206, 101	63. 4	90, 261	27. 8	324, 964
Texas: Furnace plant	8, 638	4. 5	47, 707	24. 9	135, 224	70. 6	191, 569
Utah: Furnace plants	213	(2)			1, 271, 562	100. 0	1, 271, 775
West Virginia:							
Merchant plants	73, 979	5. 7			1, 218, 118	94. 3	1, 292, 097
Furnace plants	177, 335	7. 9			2, 074, 356	92. 1	2, 251, 691
Total West Virginia	251, 314	7. 1			3, 292, 474	92. 9	3, 543, 788
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin: Merchant plants	758, 036	26. 2	196, 647	6. 8	1, 937, 074	67. 0	2, 891, 757
	17,695,126	20. 3	12,277,144	14. 1	57,155,904	65. 6	87, 128, 174
At merchant plants	3,841,088	20. 9	3,197,588	17. 4	11,309,581	61. 7	18, 348, 257
At furnace plants	13,854,038	20. 1	9,079,556	13. 2	45,846,323	66. 7	68, 779, 917

[1] Low-volatile—dry V. M. 22 percent or less and more than 14 percent; medium-volatile—dry V. M. 31 percent or less and more than 22 percent; high-volatile—dry V. M. more than 31 percent.
[2] Less than 0.05 percent.

Blending.—Blending a variety of coking coals before charging into byproduct ovens is widely practiced in the coke industry and is employed primarily to produce coke economically and of a quality satisfactory for the use for which it is intended. This practice also permits the use of coals that have good coking properties but contain some objectionable impurities, such as ash, sulfur, or phosphorus, which would prohibit their use as 100-percent charge into ovens to produce coke to conform with specifications. Further, the mixing of coking coals provides a means of controlling the quality and strength of the coke and the yield of the byproducts and permits flexible operation of byproduct plants with reference to the supply of coking coals.

The majority of coke plants in the United States mix their coals before charging into ovens, and in 1945, 74 of the 87 active plants carbonized coals of different volatile content. High- and low-volatile coals were carbonized by 44 plants; high-, medium-, and low-volatile by 25 plants; high- and medium-volatile by 2 plants; and medium- and low-volatile by 3 plants. A few plants have substituted anthracite fines for low-volatile coal in recent years, and in 1945, 12 plants used anthracite in their coal mix. Of the plants that did not carbonize coals of different volatile content, 10 charged high-volatile and 3 medium-volatile. Table 27 shows the purchase, by States, of the coals used in the manufacture of byproduct coke, classified according to volatile content. In 1945, 66 percent of the total purchases of byproduct coal was high-volatile, 20 percent low-volatile, and 14 percent medium-volatile coal, compared with 67, 28, and 13 percent, respectively, in 1944.

YIELD OF COKE PER TON OF COAL

TABLE 28.—*Yield of coke from coal in byproduct and beehive ovens in the United States, 1937 and 1943–45, by States, in percent*

State	1937		1943		1944		1945	
	Byproduct	Beehive	Byproduct	Beehive	Byproduct	Beehive	Byproduct	Beehive
Alabama	72.37	--------	72.48	59.66	72.34	--------	71.62	--------
California	--------	--------	56.62	--------	59.29	--------	58.27	--------
Colorado	67.36	55.71	63.71	64.34	64.32	65.36	65.18	64.96
Illinois	70.54	--------	70.15	--------	70.75	--------	70.83	--------
Indiana	72.04	--------	72.75	--------	73.13	--------	73.48	--------
Maryland	72.62	--------	72.78	--------	72.84	--------	73.16	--------
Massachusetts	69.99	--------	70.62	--------	70.49	--------	70.85	--------
Michigan	71.05	--------	72.03	--------	72.60	--------	71.42	--------
Minnesota	70.27	--------	74.41	--------	71.58	--------	71.33	--------
New Jersey	70.78	--------	71.64	--------	70.75	--------	71.29	--------
New York	71.75	--------	71.50	--------	70.66	--------	70.40	--------
Ohio	71.61	--------	71.97	--------	71.88	--------	71.26	--------
Pennsylvania	68.83	65.50	68.27	64.55	70.02	64.58	70.14	64.46
Tennessee	69.00	53.89	71.14	59.43	71.73	57.35	74.34	--------
Texas	--------	--------	--------	--------	69.53	--------	69.55	--------
Utah	56.67	54.25	58.99	43.51	53.98	50.19	57.33	52.93
Virginia	--------	58.33	--------	58.63	--------	58.53	--------	58.75
Washington	56.11	--------	65.32	--------	--------	--------	--------	--------
West Virginia	70.67	61.74	70.72	61.89	69.92	62.94	70.09	62.64
United States average	70.73	64.23	70.81	63.77	71.01	64.22	70.94	64.10

COKE BREEZE

TABLE 29.—*Coke breeze recovered at coke plants in the United States in 1945, by States*

State	Yield per ton of coal (percent)[1]	Produced		Used by producer: For steam raising		Used by producer: For other purposes including water gas		Sold		Wasted (net tons)	On hand Dec. 31 (net tons)
		Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value		
Byproduct:											
Alabama	3.70	278,701	$925,480	126,820	$322,391	25,985	$87,714	113,013	$477,192		23,615
California	5.46	24,000	(2)			16,092	(2)	10,061	(2)		35,303
Colorado	9.06	88,782	(2)	21,916	(2)	55,087	(2)	14,392	(2)		4,871
Illinois	6.65	345,664	1,003,964	183,357	573,427	68,932	266,554	123,653	251,227		109,289
Indiana	5.28	561,127	1,662,796	350,009	1,281,674	113,887	350,592	190,734	274,563		170,867
Maryland	7.39	204,582	(2)	47,778	(2)	27,121	(2)	129,474	(2)		209,287
Massachusetts	7.31	118,644	(2)	122,201	(2)	5,556	(2)	5,853	(2)		9,950
Michigan	5.65	222,066	801,850	120,315	397,455	22,987	84,860	76,547	312,292		35,770
Minnesota	7.68	88,839	280,121	60,301	176,657	8,553	(2)	17,618	51,004		39,238
New Jersey	6.36	114,568	(2)	108,323	(2)			264	(2)		13,916
New York	5.55	456,522	1,392,808	376,505	1,088,500	80,100	260,506	54,422	192,434		61,492
Ohio	5.81	766,741	1,842,025	442,186	1,011,548	241,265	554,073	103,167	340,927		113,560
Pennsylvania	4.21	914,974	2,016,677	1,077,625	2,634,546	52,459	100,348	130,604	269,309		97,958
Tennessee	2.84	9,060	(2)	4,504	(2)			9,302	(2)		6,970
Texas	3.83	7,727	(2)			5,125	(2)	66	(2)		2,536
Utah	7.94	101,253	(2)	105,923	(2)	15,912	(2)	51,379	(2)		46,953
West Virginia	4.73	147,382	263,828	97,071	177,403	31,101	49,273	31,675	53,132		22,757
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5.96	177,901	561,352	160,675	482,305	32	74	26,666	103,821		18,229
Undistributed			1,784,472		1,043,328		298,185		672,525		
Total, 1945	5.31	4,628,533	12,535,373	3,405,509	9,189,234	770,194	2,052,179	1,088,890	2,998,426		1,022,561
At merchant plants	5.85	1,072,555	3,345,635	845,855	2,445,664	70,367	239,263	189,543	758,259		169,376
At furnace plants	5.17	3,555,978	9,189,738	2,559,654	6,743,570	699,827	1,812,916	899,347	2,240,167		853,185
Total, 1944	5.29	4,965,064	13,281,342	3,350,917	8,526,914	732,744	1,775,873	1,018,147	3,244,128		1,491,784
Beehive:											
Colorado	3.04	3,406	(2)			3,406	(2)				
Pennsylvania	3.74	87,128	88,654	22,364	21,492			89,352	(2)	31,306	
Utah	2.64	210	(2)					153	(2)	57	
Virginia	.03	52	(2)			52	(2)				20
West Virginia	2.00	1,498	(2)							1,498	
Undistributed			8,093				6,355		63,068		
Total, 1945	3.43	92,294	96,747	22,364	21,492	3,458	6,355	89,505	63,068	[3] 32,861	20

[1] Computed by dividing production of breeze by coal charged at plants actually recovering. [2] Included under "Undistributed." [3] As reported; quantity produced but not used was undoubtedly greater. See Mineral Resources of the United States, 1922, pt. II, pp. 726–727.

RECLAIMED COKE

TABLE 30.—*Shipments and value of reclaimed beehive coke in Pennsylvania in 1945, by months and sizes*

Month	Less than 1 inch			1 inch or more			Total		
	Net tons	Value		Net tons	Value		Net tons	Value	
		Total	Average		Total	Average		Total	Average
January	24,351	$84,442	$3.47	17,605	$93,871	$5.33	41,956	$178,313	$4.25
February	46,357	164,343	3.55	39,061	209,151	5.35	85,418	373,494	4.37
March	86,100	310,897	3.61	53,630	286,643	5.34	139,730	597,540	4.28
April	80,527	289,064	3.59	52,588	278,852	5.30	133,115	567,916	4.27
May	87,184	303,413	3.48	54,550	275,921	5.06	141,734	579,334	4.09
June	99,644	350,488	3.52	51,861	271,650	5.24	151,505	622,138	4.11
July	90,791	290,740	3.20	46,366	243,337	5.25	137,157	534,077	3.89
August	69,409	225,524	3.25	31,433	163,993	5.22	100,842	389,517	3.86
September	21,895	60,648	2.77	9,809	51,359	5.24	31,704	112,007	3.53
October	2,954	10,748	3.64	2,482	13,424	5.41	5,436	24,172	4.45
November	1,495	5,415	3.62	1,181	6,366	5.39	2,676	11,781	4.40
December	3,869	13,776	3.56	5,994	27,172	4.53	9,863	40,948	4.15
	614,576	2,109,498	3.43	366,560	1,921,739	5.24	981,136	4,031,237	4.11

ANALYSES OF BYPRODUCT COKE

TABLE 31.—*Analyses of byproduct coke in 1945, by months, in percent*

Month	Volatile matter		Fixed carbon		Ash		Sulfur		Phosphorus	
	Foundry	Other coke	Foundry	Other coke	Foundry	Other coke	Foundry	Other coke	Foundry	Other coke
At merchant plants:										
January	0.90	1.19	90.39	89.90	8.71	8.91	0.62	0.71	0.019	0.014
February	.91	1.14	90.49	89.76	8.60	9.10	.62	.68	.017	.013
March	.93	1.23	90.26	89.81	8.81	8.96	.62	.67	.019	.012
April	.89	1.17	90.46	89.83	8.65	9.00	.68	.68	.020	.014
May	.89	1.17	90.26	89.81	8.85	9.02	.62	.67	.021	.014
June	.95	1.31	90.19	89.48	8.86	9.21	.62	68	.020	.016
July	.97	1.28	90.24	89.51	8.79	9.21	.62	.67	.022	.014
August	.92	1.21	90.28	89.39	8.80	9.40	.62	.71	.022	.015
September	.88	1.23	90.13	89.50	8.99	9.27	.61	.70	.021	.014
October	.86	1.18	90.26	89.60	8.88	9.22	.62	.70	.019	.016
November	.89	1.10	90.29	89.48	8.82	9.42	.62	.68	.020	.013
December	.93	1.22	90.12	89.51	8.95	9.27	.62	.71	.019	.015
	.91	1.20	90.28	89.64	8.81	9.16	.63	.69	.020	.014
At furnace plants:										
January	.96	.91	91.44	88.32	7.60	10.77	.58	.86	.023	.019
February	1.06	.91	90.98	88.37	7.96	10.72	.63	.86	.021	.018
March	.93	.91	91.21	88.30	7.86	10.79	.54	.85	.011	.018
April	.95	.94	90.93	88.18	8.12	10.88	.62	.84	.021	.018
May	.93	.95	91.09	88.22	7.98	10.83	.59	.84	.022	.018
June	.95	.99	90.98	88.03	8.07	10.98	.59	.85	.022	.018
July	.90	.95	90.92	88.03	8.18	11.02	.60	.86	.024	.018
August	.84	.95	90.98	88.03	8.18	11.02	.63	.87	.022	.019
September	.88	.92	90.80	88.14	8.32	10.94	.61	.86	.025	.018
October	.85	.86	90.99	88.08	8.16	11.06	.60	.86	.021	.019
November	.89	.89	90.55	88.01	8.56	11.10	.61	.88	.020	.018
December	.84	.87	90.78	88.23	8.38	10.90	.60	.88	.023	.017
	.91	.92	90.97	88.17	8.12	10.91	.60	.86	.021	.018
Total:										
January	.91	.97	90.61	88.65	8.48	10.38	.61	.83	.020	.018
February	.94	.96	90.60	88.66	8.46	10.38	.62	.82	.018	.017
March	.93	.98	90.51	88.61	8.56	10.41	.60	.82	.016	.017
April	.91	.99	90.58	88.54	8.51	10.47	.68	.81	.020	.017
May	.90	.99	90.47	88.55	8.63	10.46	.61	.81	.022	.018
June	.95	1.06	90.40	88.33	8.65	10.61	.61	.82	.021	.018
July	.95	1.02	90.41	88.33	8.64	10.65	.61	.82	.023	.018
August	.90	1.00	90.46	88.33	8.64	10.67	.62	.79	.022	.018
September	.88	.99	90.29	88.44	8.83	10.57	.61	.83	.022	.018
October	.86	.93	90.43	88.43	8.71	10.64	.62	.82	.020	.018
November	.89	.93	90.35	88.32	8.76	10.75	.62	.83	.020	.018
December	.91	.94	90.27	88.52	8.82	10.54	.61	.84	.020	.017
	.91	.98	90.45	88.48	8.64	10.54	.62	.82	.020	.018

CONSUMPTION OF COKE

The indicated consumption of coke in the United States in 1945, allowing for imports, exports, and changes in producers' stocks, declined 9 percent from the previous maximum in 1944. This decrease was due principally to the sharp reduction in coke consumed in iron furnaces, which, according to the American Iron and Steel Institute, dropped from 57,071,689 tons in 1944 to 50,653,221 tons, a decrease of 11 percent. Consumption of coke for other industrial purposes (in foundries, in nonferrous smelting, in the manufacture of water gas and producer gas, and for miscellaneous uses) and for domestic heating also decreased slightly from 1944. At the close of 1945, however, evidence pointed toward an increase in the consumption of coke for uses other than iron furnaces, particularly in the domestic-coke trade, where consumption was approximately 3 million tons lower than in 1940.

The efficiency of fuel utilization in blast-furnace operations declined for the fourth consecutive year in 1945, and the quantity of coke used per ton of pig iron and ferro-alloys reached the highest figures reported since 1927. According to data compiled by the American Iron and Steel Institute, the quantity of coke used per ton of pig iron produced in 1945 increased 30.2 pounds over 1944; and for pig iron and ferro-alloys, the gain was 29.4 pounds.

TABLE 32.—*Coke consumed in manufacture of pig iron and for other purposes in the United States, 1913, 1918, 1937, and 1944–45, in net tons*

Year	Total production	Imports	Exports	Net change in stocks	Indicated United States consumption [1]	Consumed by iron furnaces [2]		Remainder consumed in other ways	
						Quantity	Percent	Quantity	Percent
1913	46,299,530	101,212	987,395	(3)	45,413,347	37,192,287	81.9	8,221,060	18.1
1918	56,478,372	30,168	1,687,824	(3)	54,820,716	45,703,594	83.4	9,117,122	16.6
1937	52,375,469	286,364	526,683	+863,221	51,271,929	33,571,349	65.5	17,700,580	34.5
1944	74,037,817	63,004	866,835	+262,585	72,971,401	57,071,689	78.2	15,899,712	21.8
1945	67,308,181	51,964	1,478,746	−192,872	66,074,271	50,653,221	76.7	15,421,050	23.3

[1] Production plus imports minus exports, plus or minus decrease or increase, respectively, of net changes in stocks.
[2] From Report of American Iron and Steel Institute. Figures include coke consumed in manufacture of ferro-alloys.
[3] Data not available.

TABLE 33.—*Coke and coking coal consumed per net ton of pig iron made in the United States, 1913, 1918, 1937, and 1943–45*

Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)	Year	Coke per net ton of pig iron and ferro-alloys [1] (pounds)	Yield of coke from coal (percent)	Coking coal per net ton of pig iron and ferro-alloys (pounds calculated)
1913	2,172.6	66.9	3,247.5	1943	1,834.3	70.0	2,620.4
1918	2,120.7	66.4	3,193.8	1944	1,840.6	70.3	2,618.2
1937	1,830.6	70.3	2,604.0	1945	1,870.0	70.4	2,656.3

[1] From Report of American Iron and Steel Institute; consumption per ton of pig iron only, excluding furnaces making ferro-alloys, was 2,172.6 pounds in 1913, 2,120.7 in 1918, 1,806.7 in 1937, 1,800.6 in 1943, 1,809.8 in 1944, and 1,840.0 in 1945.

FURNACE, FOUNDRY, DOMESTIC, AND OTHER COKE

Disposal, by major uses, of byproduct and beehive coke as reported by producers is shown in tables 34 and 35. As all producers, especially those that sell through middlemen, cannot furnish precise information on the ultimate use for the portion sold, the Bureau asks for a separation of sales to affiliated plants and to other purchasers into the broad classifications "furnace," "foundry," etc., and for the use to which that part of the output consumed by the producers is put. A close business relationship exists between the blast furnaces, which are the largest users of coke, and the coke plants. The proportion of the byproduct coke reported as used by the producers in integrated iron blast furnaces and sales to financially affiliated plants for blast furnace use was 72 percent of the total output, and even this high percentage does not indicate the full extent of the interrelationship of the byproduct coke and iron industry, as 78 percent of the byproduct coke produced in 1945 came from ovens associated with furnaces. Iron blast furnaces in 1945 received 46,910,622 tons of byproduct coke (76 percent of the total coke sold or used by producers), a 9-percent decrease from the record total of 1944. The second largest disposal channel for byproduct coke is the domestic market, supplied principally by "merchant" plants. Sales to this market increased slightly

TABLE 34.—*Byproduct coke produced and sold or used by producer in the United States in 1945, by States*

State	Produced		Used by producer— In blast furnaces		Used by producer— For other purposes [1]		Sold — Furnace [2]	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	5,400,925	$33,448,229	4,319,575	$24,771,710	16,605	(5)	36,468	$232,894
California	256,092	(5)	260,996	(5)	1,112	(5)	----------	----------
Colorado	639,099	(5)	605,458	(5)	9,828	(5)	----------	----------
Illinois	3,681,516	32,377,629	1,644,644	13,417,966	97,187	$748,828	1,217,922	10,558,484
Indiana	7,814,247	68,458,007	5,322,778	46,753,353	101,822	746,738	1,546,329	13,377,998
Maryland	2,024,609	(5)	2,058,067	(5)	726	(5)	----------	----------
Massachusetts	1,149,448	(5)	----------	----------	136,291	(5)	----------	----------
Michigan	2,805,970	24,119,361	1,218,449	(5)	143,552	1,116,496	133,012	(5)
Minnesota	825,620	7,760,362	403,325	(5)	8,945	55,178	----------	----------
New Jersey	1,284,020	(5)	----------	----------	197,874	(5)	17,491	(5)
New York	5,789,974	46,676,238	1,595,602	(5)	989,996	6,889,210	1,508,095	11,054,919
Ohio	9,405,710	70,381,885	7,027,506	51,838,288	98,552	911,567	940,454	6,987,669
Pennsylvania	15,255,137	98,161,908	7,615,815	54,882,044	139,937	1,018,624	6,361,968	33,343,138
Tennessee	236,979	(5)	116,561	(5)	----------	----------	----------	----------
Texas	140,254	(5)	132,537	(5)	----------	----------	----------	----------
Utah	731,306	(5)	612,190	(5)	1,741	(5)	----------	----------
West Virginia	2,462,477	11,939,470	1,432,331	(5)	660,951	3,776,553	213,431	(5)
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	2,190,905	19,840,493	----------	----------	198,617	1,616,822	569,618	3,420,696
Undistributed	----------	57,026,757	----------	65,066,612	----------	2,688,936	----------	2,438,333
Total, 1945	62,094,288	470,190,339	34,365,834	256,729,973	2,803,736	19,568,952	12,544,788	81,414,131
At merchant plants	13,399,116	118,229,418	----------	----------	2,577,084	17,863,645	1,572,986	12,044,595
At furnace plants	48,695,172	351,960,921	34,365,834	256,729,973	226,652	1,705,307	10,971,802	69,369,536
Total, 1944	67,064,795	478,844,172	37,753,934	262,966,060	2,934,769	18,824,163	13,916,855	86,572,409

See footnotes at end of table.

TABLE 34.—*Byproduct coke produced and sold or used by producer in the United States in 1945, by States*—Continued

State	Sold—Continued							
	Foundry [3]		Domestic		Industrial and other (including water gas) [4]		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Alabama	321,919	$3,094,017	162,963	$978,441	498,570	$4,014,164	1,019,920	$8,319,516
California	964	(5)	7,747	(5)	1,161	(5)	9,872	(5)
Colorado	1,006	(5)	---	---	20,722	(5)	21,728	(5)
Illinois	314,448	3,814,517	356,373	3,414,817	84,352	730,780	1,973,095	18,518,598
Indiana	337,079	3,915,325	360,280	2,378,008	92,343	794,832	2,336,031	20,466,163
Maryland	---	---	---	---	---	---	---	---
Massachusetts	63,526	(5)	835,113	(5)	114,979	(5)	1,013,618	(5)
Michigan	390,447	(5)	637,525	5,479,809	270,393	2,405,456	1,431,377	13,660,481
Minnesota	10,610	(5)	306,053	3,267,206	75,076	(5)	391,739	4,154,808
New Jersey	46,341	(5)	567,142	(5)	442,881	(5)	1,073,855	(5)
New York	---	---	1,334,078	11,209,095	420,179	3,391,503	3,262,352	25,655,517
Ohio	242,166	2,705,425	352,867	2,462,184	694,208	5,106,741	2,229,695	17,262,019
Pennsylvania	227,996	2,592,675	724,432	4,745,182	264,000	2,128,831	7,578,396	42,809,826
Tennessee	41,714	(5)	1,007	(5)	81,264	(5)	123,985	(5)
Texas	---	---	---	---	8,708	(5)	8,708	(5)
Utah	---	---	2,590	(5)	57,229	(5)	59,819	(5)
West Virginia	67,911	(5)	21,494	120,393	67,565	(5)	370,401	2,286,876
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	271,906	3,473,026	904,862	9,072,903	285,631	2,712,052	2,032,017	18,678,677
Undistributed	---	7,238,661	---	13,996,291	---	7,359,325	---	22,203,309
Total, 1945	2,338,033	26,833,646	6,574,526	57,124,329	3,479,261	28,643,684	24,936,608	194,015,790
At merchant plants	1,743,106	20,115,608	4,829,936	45,861,215	2,742,541	23,038,343	10,888,569	101,059,761
At furnace plants	594,927	6,718,038	1,744,590	11,263,114	736,720	5,605,341	14,048,039	92,956,029
Total, 1944	[6] 2,233,808	[6] 24,627,226	6,443,329	55,575,253	[6] 3,437,438	[6] 27,383,631	26,031,430	194,158,519

[1] Comprises 43,936 tons valued at $384,697 used in foundries; 807,926 tons, $5,598,986 used to make producer gas; 1,625,879 tons, $10,998,464 to make water gas; and 325,995 tons, $2,586,805 used for other purposes.
[2] Includes 10,518,776 tons valued at $65,476,552 sold to financially affiliated plants.
[3] Includes 3,206 tons valued at $19,539 sold to financially affiliated plants.
[4] Includes 380,977 tons valued at $2,994,546 for manufacture of water gas and 169,269 tons, $1,204,260 for other industrial use sold to financially affiliated plants; and 1,076,144 tons, $8,927,407 for manufacture of water gas sold to other consumers.
[5] Included under "Undistributed."
[6] Revised figure.

over 1944 and were equivalent to 11 percent of byproduct coke production in 1945. Byproduct coke sold or used by producers for foundry use varied only slightly from 1944 and totaled 2,381,969 tons, of which 73 percent was supplied by merchant plants. Byproduct coke sold or used for other industrial purposes (including coke used in the manufacture of water gas and producer gas) constituted about 10 percent of the total production, the same proportion as in 1944.

In 1945, the producers of beehive coke reported sales of 4,929,553 tons, of which 35 percent was furnace coke sold to financially affiliated plants, 43 percent was furnace coke sold to nonaffiliated purchasers (merchant sales), 5 percent was foundry coke, 4 percent was sold for domestic use, and 13 percent was sold for other industrial purposes (including the manufacture of water gas). The quantity of beehive coke used by the producers themselves was 316,982 tons, of which all but 76,435 tons was consumed in iron blast furnaces.

TABLE 35.—*Beehive coke produced and sold or used by producer in the United States in 1945, by States*

State	Produced		Used by producer—				Sold	
			In blast furnaces		For other purposes		Furnace [1]	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Colorado	72,678	(2)			72,553	(2)		
Kentucky	74,404	(2)					41,966	(2)
Pennsylvania	4,583,720	$33,233,516	240,547	$1,884,251	3,850	$29,304	3,612,053	$25,827,068
Utah	4,205	(2)					2,481	(2)
Virginia	191,032	1,541,650					49,734	390,095
West Virginia	287,854	2,228,115			32	(2)	145,518	1,054,376
Undistributed		1,346,422				689,672		359,288
Total: 1945	5,213,893	38,349,703	240,547	1,884,251	76,435	718,976	3,851,752	27,630,827
1944	6,973,022	49,077,334	674,055	4,957,103	88,800	817,804	5,136,509	35,289,195

State	Sold—Continued							
	Foundry		Domestic		Industrial and other (including water gas) [3]		Total	
	Net tons	Value	Net tons	Value	Net tons	Value	Net tons	Value
Colorado	293	(2)			77	(2)	370	(2)
Kentucky					32,438	(2)	74,404	(2)
Pennsylvania	192,345	$1,577,564	168,259	$1,228,014	398,305	$2,937,080	4,370,962	$31,569,726
Utah	235	(2)			1,387	(2)	4,103	(2)
Virginia	26,127	232,501	3,621	24,688	111,033	890,483	190,515	1,537,767
West Virginia	35,762	340,547	29,102	208,700	78,817	634,150	289,199	2,237,773
Undistributed		5,306				293,579		658,173
Total: 1945	254,762	2,155,918	200,982	1,461,402	622,057	4,755,292	4,929,553	36,003,439
1944	231,175	1,936,046	274,214	1,910,675	563,926	4,125,968	6,205,824	43,261,884

[1] Includes 1,725,385 tons valued at $11,942,926 sold to financially affiliated plants for blast furnace use.
[2] Included under "Undistributed."
[3] Includes 459 tons valued at $3,833 sold to financially affiliated plants for other industrial use and 187,697 tons, $1,440,222 for manufacture of water gas sold to other consumers.

STOCKS OF COKE AND COKING COAL

Coke.—The extremely heavy demand for coke throughout 1945 made it necessary for byproduct producers to draw from stocks, and therefore total inventories at the end of the year were 15 percent lower than on January 1, 1945, and were equivalent to but 5.6 days' production at the rate prevailing in December 1945. During the same period, stocks of furnace coke declined 11 percent, and domestic and other coke 19 percent, whereas foundry-coke stocks increased 34 percent. Beehive plants carry small stocks of coke, and at the end of 1945 only 4,814 tons were in reserve. Table 36 shows the stocks of coke and breeze on hand at all plants, by States, on January 1, 1946. Table 38 shows the stocks of coke on hand at producers' plants, by months, during 1944–45.

TABLE 36.—*Stocks of furnace, foundry, and domestic coke and of breeze in the United States on Jan. 1, 1946, by States, in net tons*

State	Coke				Breeze
	Furnace	Foundry	Domestic and other	Total	
Byproduct:					
Alabama	106.088	5,590	11,268	122,946	23,615
California	13,822	45	----	13,867	35,303
Colorado	3,795	----	----	3,795	4,871
Illinois	10,543	968	17,950	29,461	109,289
Indiana	72,025	3,756	31,042	106,823	170,867
Maryland	9,283	----	----	9,283	209,287
Massachusetts	----	53	101,352	101,405	9,950
Michigan	4,064	696	4,063	8,823	35,770
Minnesota	1,433	1,380	35,919	38,732	39,238
New Jersey	----	----	21,237	21,237	13,916
New York	32,708	36	120,016	152,760	61,492
Ohio	76,643	9,651	10,903	97,197	113,560
Pennsylvania	64,378	231	17,044	81,653	97,958
Tennessee	1,521	1,177	2,182	4,880	6,970
Texas	----	----	580	580	2,536
Utah	10,901	----	34,613	45,514	46,953
West Virginia	8,046	420	18,316	26,782	22,757
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	10,188	506	50,567	61,261	18,229
	425,438	24,509	477,052	926,999	1,022,561
At merchant plants	16,450	21,313	390,401	428,164	169,376
At furnace plants	408,988	3,196	86,651	498,835	853,185
Beehive:					
Colorado	----	----	----	----	----
Kentucky	----	----	----	----	----
Pennsylvania	1,448	131	1,824	3,403	----
Utah	182	----	----	182	----
Virginia	825	126	245	1,196	20
West Virginia	----	13	20	33	----
	2,455	270	2,089	4,814	20

TABLE 37.—*Summary of total stocks of coke on hand at all byproduct and beehive plants in the United States on Jan. 1, 1937 and 1942–46, in net tons*

[Exclusive of screenings or breeze]

	1937	1942	1943	1944	1945	1946
Byproduct plants:						
Furnace	282,144	697,898	770,135	517,452	478,133	425,438
Foundry	8,981	20,448	21,937	21,490	18,265	24,509
Domestic and other	1,408,350	991,045	661,401	286,671	590,048	477,052
	1,699,475	1,709,391	1,453,473	825,613	1,086,446	926,999
Beehive plants:						
Furnace	5,622	20,311	24,617	30,740	33,649	2,455
Foundry	8,508	4,987	2,203	482	766	270
Domestic and other	18,461	23,397	8,756	5,265	3,824	2,089
	32,591	48,695	35,576	36,487	38,239	4,814
Total:						
Furnace	287,766	718,209	794,752	548,192	511,782	427,893
Foundry	17,489	25,435	24,140	21,972	19,031	24,779
Domestic and other	1,426,811	1,014,442	670,157	291,936	593,872	479,141
	1,732,066	1,758,086	1,489,049	862,100	1,124,685	931,813

TABLE 38.—*Total stocks of coke at all furnace and nonfurnace byproduct plants in the United States on first of each month, 1944–45, in net tons*

[Includes furnace, foundry, and domestic, but not breeze]

Month	Furnace plants		Other plants		Total	
	1944	1945	1944	1945	1944	1945
January	528, 511	589, 524	297, 102	496, 922	825, 613	1, 086, 446
February	640, 846	609, 395	208, 493	303, 905	849, 339	913, 300
March	561, 021	584, 028	151, 659	194, 514	712, 680	778, 542
April	513, 404	498, 917	108, 582	177, 696	621, 986	676, 613
May	535, 244	428, 898	149, 454	204, 350	684, 698	633, 248
June	569, 441	514, 423	186, 439	209, 734	755, 880	724, 157
July	553, 789	597, 533	230, 688	274, 880	784, 477	872, 413
August	589, 067	568, 924	331, 765	357, 388	920, 832	926, 312
September	596, 014	674, 026	389, 615	428, 376	985, 629	1, 102, 402
October	565, 118	658, 483	430, 134	518, 285	995, 252	1, 176, 768
November	585, 899	481, 371	454, 097	482, 032	1, 039, 996	963, 403
December	688, 327	489, 767	509, 229	512, 256	1, 197, 556	1, 002, 023

Coal.—Because byproduct coking is a continuous process, adequate reserves of coking coal are essential to assure full-scale operations. Stocks of bituminous coal at byproduct-coke plants at the beginning of 1945 totaled 6,111,538 tons, a quantity sufficient for 24 days' average requirements at the rate of consumption prevailing in December 1944. However, because of the heavy demand for bituminous coal throughout the year, stocks at byproduct-coke plants could not be built up, and when mine stoppages in October hampered the flow of coking coal stocks were reduced to the lowest point since July 1, 1939. On an industry-wide basis the tonnage on hand on October 31, 1945, was sufficient for 14 days' supply if based on the normal average daily requirements of all plants, but inventories at many of the large steel companies' coke plants averaged less than a week's supply. Although stocks increased in November and December, the tonnage on hand at the end of the year was far short of the reserves normally carried by the operators. Table 39 shows the stocks of bituminous coal at byproduct-coke plants, by months, for 1937 and 1943–45.

TABLE 39.—*Stocks of bituminous coal at byproduct-coke plants in the United States at the end of each month, 1937 and 1943–45*

Month	1937	1943	1944	1945
January	8, 030, 871	9, 952, 627	6, 137, 165	5, 694, 501
February	8, 687, 389	9, 778, 403	6, 382, 553	5, 610, 111
March	9, 638, 317	9, 850, 617	6, 280, 880	5, 452, 042
April	8, 543, 774	9, 732, 267	5, 929, 623	4, 456, 204
May	8, 187, 883	9, 219, 153	5, 891, 893	4, 428, 452
June	7, 770, 256	7, 142, 587	6, 127, 041	5, 128, 071
July	7, 432, 741	6, 818, 746	5, 708, 408	4, 752, 624
August	7, 455, 932	6, 811, 435	5, 927, 586	4, 502, 647
September	7, 760, 533	6, 590, 622	6, 173, 834	4, 624, 488
October	8, 066, 938	6, 657, 479	6, 396, 922	3, 665, 833
November	8, 114, 094	5, 819, 664	6, 737, 442	4, 607, 047
December	7, 273, 403	6, 305, 514	6, 111, 538	4, 873, 546

VALUE AND PRICE

The term "value" as applied to coke in this report means the value at ovens. Over 61 percent of the byproduct coke produced is made in ovens operated by corporations, which not only mine the coal they use but also operate blast furnaces that consume the bulk of the output of their ovens. This coke is not sold but is transferred by an interdepartment credit and charged on the books of the corporation owning both the coke and metallurgical plants. For the part of the output that is sold, the value is the amount received for the coke f. o. b. ovens. The total value of all byproduct coke produced in 1945, measured in this manner, decreased $8,653,833 from 1944, or less than 2 percent, and for beehive coke $10,727,631, or 22 percent (tables 34 and 35). The average value per ton of byproduct coke rose from $5.06 in 1936 to $5.16 in 1938 and after a temporary drop in 1939–40 increased steadily to $7.57 per ton in 1945. In like manner the average value of beehive coke increased from $3.91 in 1936 to $7.36 in 1945 and approached the maximum of $7.94 in 1920. The trend of the average value per ton during the last 10 years is shown in table 40.

Because of the various accounting methods used by coke operators affiliated with iron and steel plants, a better index of value changes in the market is provided by the average receipts per ton of coke sold. The average receipts from sales of byproduct coke in 1945 were $7.78 a ton, an increase of $0.32 over the average for the preceding year. The average for beehive coke rose from $6.97 in 1944 to $7.30 a ton in 1945.

The average receipts from sales represent the realization per net ton f. o. b. ovens and vary notably with the distances the coke plants are located from the mines. Thus the highest average receipts for domestic coke are those reported for Minnesota, where the coal must be hauled by rail-lake-rail from the Appalachians or even by longer all-rail routes. For details on average receipts that can be published without revealing individual operations, see table 41.

TABLE 40.—*Average value per net ton of all coke produced and average receipts per net ton from all coke sold in the United States, 1936–45*

Year	Value per ton produced			Receipts per ton sold		
	By-product	Beehive	Total	By-product	Beehive	Total
1936	$5.06	$3.91	$5.02	$5.83	$3.92	$5.65
1937	5.03	4.31	4.98	6.11	4.23	5.83
1938	5.16	4.42	5.14	6.00	4.27	5.90
1939	4.81	4.45	4.80	5.75	4.31	5.63
1940	4.82	4.41	4.80	5.87	4.34	5.68
1941	5.41	5.44	5.41	6.71	5.54	6.42
1942	6.07	5.75	6.03	7.33	5.75	6.87
1943	6.65	6.55	6.64	6.93	6.53	6.85
1944	7.14	7.04	7.13	7.46	6.97	7.36
1945	7.57	7.36	7.56	7.78	7.30	7.70

TABLE 41.—*Average receipts per net ton for coke sold in the United States in 1945, by States*

State	Byproduct					Beehive				
	Furnace		Foundry	Domestic	Other industrial, including water gas	Furnace		Foundry	Domestic	Other industrial, including water gas
	To affiliated plants	Merchant sales				To affiliated plants	Merchant sales			
Alabama	(1)	(1)	$9.61	$6.00	$8.05					
California			(1)	(1)						
Colorado			(1)		(1)			(1)		(1)
Illinois	(1)	$9.55	12.13	9.58	8.81					
Indiana	(1)	(1)	(1)	6.60	8.61					
Maryland										
Massachusetts			(1)	(1)	(1)					
Michigan		(1)	(1)	8.60	8.90					
Minnesota			(1)	10.68	(1)					
New Jersey		(1)	(1)	(1)	(1)					
New York	(1)	8.69		8.40	8.37					
Ohio	$7.44	(1)	11.18	6.98	7.34					
Pennsylvania	5.07	8.51	11.43	6.55	8.20	$6.92	$7.36	$8.20	$7.30	$7.37
Tennessee			(1)	(1)	(1)					
Texas					(1)					
Utah				(1)	(1)		(1)	(1)		(1)
Virginia							7.84	8.90	6.82	8.02
West Virginia	(1)	(1)	(1)	5.60	(1)		7.25	9.52	7.17	8.05
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin		6.01	12.77	10.03	9.43		(1)			(1)
Undistributed	7.86	8.17	11.62	9.90	8.44		8.08	10.05		8.66
United States average	6.22	7.87	11.48	8.69	8.35	6.92	7.38	8.46	7.27	7.64
At merchant plants		7.66	11.54	9.50	8.55					
At furnace plants	6.22	8.59	11.32	6.46	7.70					

1 Included under "Undistributed."

SHIPMENTS BY RAIL, WATER, AND TRUCK

As in previous years, the bulk of byproduct coke produced in the United States in 1945 was consumed in adjacent metallurgical works and but 40 percent of the total output was loaded for shipment outside the producing plants. Railroads transported 85 percent of the total byproduct-coke shipments, the same as in 1944. Truck shipments increased slightly over 1944 and represented 10 percent of the total shipments. Shipments by boat are relatively insignificant, and in 1945 less than 5 percent of the total shipments were so moved.

Unlike byproduct coke, which is mostly consumed at producing plants, beehive coke is made near the mines and is nearly all loaded at the plants for shipment to centers of consumption. In 1945, more than 94 percent of the total beehive-coke output was transported from producing plants. Shipments by rail accounted for 98 percent of all deliveries; the remaining 2 percent moved by truck and boat.

TABLE 42.—*Coke and breeze sold that was loaded at plants in the United States for shipment in 1945, by States, in net tons*

State	Coke				Breeze			
	In railroad cars	In boats	In trucks	Total	In railroad cars	In boats	In trucks	Total
Byproduct:								
Alabama	994,392		25,528	1,019,920	113,013			113,013
California	9,872			9,872	10,061			10,061
Colorado	21,526		202	21,728	14,243		149	14,392
Illinois	1,925,863		47,232	1,973,095	121,286		2,367	123,653
Indiana	2,257,842		78,189	2,336,031	189,508		1,226	190,734
Maryland					93,416	36,058		129,474
Massachusetts	566,538	30,287	416,793	1,013,618			5,853	5,853
Michigan	1,134,105	141,678	155,594	1,431,377	68,174	8,362	11	76,547
Minnesota	347,845		43,894	391,739	17,568		50	17,618
New Jersey	447,754	364,055	262,046	1,073,855	92		172	264
New York	2,347,054	108,703	806,595	3,262,352	52,458		1,964	54,422
Ohio	1,963,473	116,049	150,173	2,229,695	94,952	4,953	3,262	103,167
Pennsylvania	7,101,086	270,819	206,491	7,578,396	119,904	6,439	4,261	130,604
Tennessee	123,985			123,985	9,302			9,302
Texas	8,708			8,708	66			66
Utah	53,129		6,690	59,819	51,357		22	51,379
West Virginia	364,979		5,422	370,401	31,675			31,675
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	1,617,851	56,537	357,629	2,032,017	15,693		10,973	26,666
	21,286,002	1,088,128	2,562,478	24,936,608	1,002,768	55,812	30,310	1,088,890
At merchant plants	8,060,219	622,969	2,205,381	10,888,569	162,083	2,932	24,528	189,543
At furnace plants	13,225,783	465,159	357,097	14,048,039	840,685	52,880	5,782	899,347
Beehive:								
Colorado	370			370				
Kentucky	74,404			74,404				
Pennsylvania	4,284,558	74,898	11,506	4,370,962	78,866	10,268	218	89,352
Utah	3,391		712	4,103	145		8	153
Virginia	190,397		118	190,515				
West Virginia	289,112		87	289,199				
	4,842,232	74,898	12,423	4,929,553	79,011	10,268	226	89,505

TABLE 43.—*Beehive coke loaded for shipment on originating railroads, waterways, and trucks in the United States in 1945, by routes, as reported by producers*

Route	Producing State	Net tons		Percent of total
		By States	Total	
Railroads:				
Baltimore & Ohio	Pennsylvania	1,071,057	1,274,019	25.8
	West Virginia	202,962		
Chesapeake & Ohio	Kentucky	74,404	114,043	2.3
	West Virginia	39,639		
Denver & Rio Grande Western	Colorado	370	3,761	.1
	Utah	3,391		
Interstate	Virginia	162,482	162,482	3.3
Ligonier Valley	Pennsylvania	48,023	48,023	1.0
Louisville & Nashville	Virginia	895	895	(1)
Monongahela	Pennsylvania	1,157,338	1,157,338	23.5
New York Central	West Virginia	46,511	46,511	.9
Norfolk & Western	Virginia	27,020	27,020	.6
Pennsylvania	Pennsylvania	1,987,548	1,987,548	40.3
Pittsburgh & Lake Erie	do	20,592	20,592	.4
Total railroad shipments		4,842,232	4,842,232	98.2
Waterways: Monongahela & Ohio Rivers	Pennsylvania	74,898	74,898	1.5
Trucks	(2)	12,423	12,423	.3
Grand total		4,929,553	4,929,553	100.0

[1] Less than 0.05 percent.
[2] Pennsylvania, Utah, Virginia, and West Virginia.

DISTRIBUTION OF BYPRODUCT AND BEEHIVE COKE

Table 44 contains data on the comparative consumption of byproduct and beehive coke and coke breeze, by States, in 1945 and shows the distribution, by major uses, of large coke in a given State. This summary table was compiled from information submitted by the coke-producing companies on the ultimate State destination of their coke and breeze. Total consumption of coke in the United States in 1945 decreased 9 percent from the peak attained in 1944 and amounted to 66,448,258 net tons. Although consumption of large coke showed a sharp decline, the quantity of coke breeze used or sold by producers increased 3 percent in the same period and totaled 5,320,257 tons. Shipments of coke and coke breeze to foreign countries registered large increases and were 31 percent and 68 percent, respectively, above the quantities exported in 1944. As shown in the summary table, distribution of coke for use in iron blast furnaces in 1945 constituted nearly 76 percent of the total deliveries from coke plants, but the tonnage involved was 11 percent below that of 1944. A slight increase was noted in shipments to iron foundries in the United States, and foreign shipments of foundry coke increased 59 percent in the same period. The domestic coke trade received approximately 10 percent of the total byproduct and beehive coke distributed in 1945, and although shipments of domestic coke within the United States dropped slightly from the 1944 deliveries, exports offset this slight decrease, and total deliveries were 57,965 tons higher than for the preceding year. The tonnage of coke used or sold by producers for the manufacture of water gas, producer gas, and other industrial purposes varied only slightly from the quantity so used in 1944 and was equivalent to 10 percent of the total coke deliveries.

TABLE 44.—*Summary of byproduct and beehive coke and breeze consumed in each State in 1945, in net tons*

[Based upon reports from all United States producers showing destination of coke used by producer or sold in 1945. Does not include imported coke which totaled 51,964 tons in 1945]

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Alabama	4,358,091	85,977		998	229,382	86,575	4,761,023	189,096
Arizona		4,202			601		4,803	
Arkansas		825		527	58	35	1,445	132
California	262,094	53,118			31,593	7,747	354,552	21,306
Colorado	605,458	14,682			28,649		648,789	93,763
Connecticut		40,360	85,559	100,190	6,258	196,355	428,722	47,099
Delaware		4,230		496	1,530	5,096	11,352	1,754
District of Columbia		194		53,970	18,622	1,932	74,718	396
Florida		1,801		46,892	2,480	3,738	54,911	1,895
Georgia		16,042		13,094	13,727	13,239	56,102	391
Idaho		419			4,075	10	4,504	153
Illinois	4,424,668	254,820	31,577	65,506	93,956	432,452	5,302,979	411,756
Indiana	5,406,093	131,635		53,754	141,668	247,986	5,981,136	490,614
Iowa		49,458		2,715	30,055	12,068	94,296	14,362
Kansas		11,464			1,911		13,375	10,298
Kentucky	569,341	16,171		72,907	14,467	55,469	728,355	48,781
Louisiana		5,822			18,518	3,072	27,412	6
Maine		4,217		3,258	247	61,325	69,047	
Maryland	2,261,071	37,407		32,445	21,349	2,009	2,354,281	186,188
Massachusetts		52,331	122,548	126,330	28,114	870,322	1,199,645	133,628
Michigan	1,267,695	318,095	5,329	5,994	295,835	736,488	2,629,436	218,531
Minnesota	403,325	34,367	7,112	5,088	68,076	282,852	800,820	86,075
Mississippi		1,112			1,007	1,537	3,656	64

TABLE 44.—*Summary of byproduct and beehive coke and breeze consumed in each State in 1945, in net tons*—Continued

[Based upon reports from all United States producers showing destination of coke used by producer or sold in 1945. Does not include imported coke which totaled 51,964 tons in 1945]

Consuming State	Coke							Coke breeze
	Furnace use	Foundry use	Making producer gas	Making water gas	Other industrial use	Domestic use	Total	
Missouri		76,733		2,025	46,489	100,462	225,709	6,864
Montana		2,194			22,896		25,090	26,195
Nebraska		3,057		11,446	4,436	1,113	20,052	106
Nevada		513			6,119		6,632	
New Hampshire		5,048		3,088	187	75,823	84,146	
New Jersey		74,563	77,331	326,226	105,129	552,199	1,135,448	135,854
New Mexico		4,447			322		4,769	
New York	3,242,590	143,725	299,257	874,186	335,614	1,375,058	6,270,430	503,871
North Carolina		11,051		5,512	5,440	5,354	27,357	504
North Dakota		210		425	460	1,325	2,420	
Ohio	9,985,887	310,043		159,639	241,511	296,701	10,993,781	776,277
Oklahoma		3,949			157		4,106	16,135
Oregon		7,939			7,456	215	15,610	3,613
Pennsylvania	16,080,883	319,276	74,320	190,697	269,396	333,701	17,268,273	1,353,617
Rhode Island		8,748	36,274	3,729	1,118	136,660	186,529	26,149
South Carolina		4,157		2,734	4,910	7,494	19,295	2,995
South Dakota		223			226	2,420	2,869	
Tennessee	113,841	77,542		48,543	68,889	6,238	315,053	94,959
Texas	132,537	27,426		2,235	50,958		213,156	6,329
Utah	613,573	11,562			45,392	2,580	673,107	137,232
Vermont		6,772		2,025	2,903	30,166	41,866	
Virginia	63,422	36,824		328,456	89,120	3,228	521,050	5,725
Washington		8,294		107	2,284	108	10,793	5,996
West Virginia	1,181,258	30,677		688,243	217,058	2,016	2,119,252	158,060
Wisconsin		147,110	68,619	36,514	19,973	371,939	644,155	103,488
Wyoming		10,005		106	1,840		11,951	
	50,971,827	2,470,837	807,926	3,270,100	2,602,461	6,325,107	66,448,258	5,320,257
Exported	31,094	165,894		597	256,469	450,401	904,455	59,663
	51,002,921	2,636,731	807,926	3,270,697	2,858,930	6,775,508	67,352,713	5,379,920

EXPORTS AND IMPORTS [12]

Shipments of coke to foreign countries in 1945 were greater than in any year since 1918. Shipments totaled 1,478,746 net tons valued at $12,600,707, an increase of 71 percent in quantity and 72 percent in value over 1944. Although foreign shipments of byproduct and beehive coke were higher than for any recent year, the large increase over 1944 was due principally to the heavy movement of reclaimed beehive coke from western Pennsylvania to Canada in the spring and summer of 1945. According to a monthly canvass of reclaimed-coke producers, conducted by the Bureau of Mines for the Solid Fuels Administration for War, monthly shipments of reclaimed coke to Canada reached a peak in July 1945, when more than 65,000 tons were destined to Canada. From information collected during the first 9 months of 1945, it is estimated that the total shipments of reclaimed coke to Canada in 1945 constituted approximately 20 percent of the total tonnage of all coke exported from the United States. Of the 1,478,746 tons of coke exported in 1945, Canada received more than 88 percent, the bulk going through the gateways of Buffalo, Michigan, and the St. Lawrence customs districts. Outside Canada, the export

[12] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

market for American coke is small, although Europe took 115,956 tons in 1945, while Cuba and South America received 27,971 tons and 19,061 tons, respectively.

Coke imports supply an insignificant part of the requirements of the country and totaled only 51,964 tons in 1945, all of which came from Canada.

TABLE 45.—*Coke exported from the United States, 1943–45, by countries and customs districts*

	1943		1944		1945	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
North America:						
Canada	962,489	$6,865,179	820,434	$6,604,080	1,305,390	$10,519,110
Mexico	6,466	52,426	6,813	68,272	8,116	60,471
Panama	6	74	3	45	3	89
West Indies:						
Cuba	2,893	37,916	15,724	226,577	27,971	341,794
Trinidad and Tobago	73	859	1,070	17,335	435	6,788
Other North America	769	22,618	1,243	28,426	1,068	25,575
South America:						
Argentina	4,988	88,861	1,765	22,883	2,384	21,323
Bolivia	296	7,291	284	6,657	609	12,887
Brazil	9,714	148,575	6,760	106,583	6,287	110,492
Chile	5,090	80,320	10,720	216,768	7,043	130,160
Peru	903	19,928	333	6,011	1,033	27,444
Venezuela	360	8,156	430	10,755	1,016	25,920
Other South America	310	6,535	133	2,274	689	9,645
Europe:						
Azores	250	3,750				
Denmark					15,462	178,423
France					10,411	106,564
Italy					7,514	21,942
Portugal					2,109	31,413
Spain			986	13,977		
Sweden					78,829	939,479
Switzerland					1,631	18,739
Asia: Philippine Islands					134	4,920
Africa:						
Morocco, French					608	7,449
Other Africa			137	3,666	4	80
	994,607	7,342,488	866,835	7,334,309	1,478,746	12,600,707
CUSTOMS DISTRICT						
Buffalo	500,418	3,328,111	420,203	2,950,673	718,940	5,236,382
Chicago			5,843	45,494	21,602	144,597
Dakota	27,722	223,400	16,045	156,320	18,324	179,803
Duluth and Superior	11,221	90,127	7,775	80,109	8,916	92,778
Florida	5,551	78,268	17,455	251,799	1,805	25,404
Laredo	1,014	9,093	1,796	18,447	2,582	29,996
Maryland	2,285	27,875	4,454	57,674	34,902	425,592
Michigan	324,258	2,600,182	311,003	2,880,247	298,258	2,819,844
Mobile	3,733	34,131	668	8,038	37,105	446,198
New Orleans	9,351	173,754	10,359	199,104	18,385	316,559
New York	3,876	90,537	4,321	111,633	2,587	62,264
Ohio	52,258	229,051	24,200	184,702	38,183	301,685
Philadelphia	459	9,891	986	13,977	60,319	614,704
St. Lawrence	15,840	116,419	29,497	250,425	183,341	1,640,091
San Diego	546	6,052	520	7,065	180	2,696
San Francisco	189	6,525	64	2,537	159	5,743
Virginia	195	2,494	1,476	22,060	10,136	128,905
Other districts	35,691	316,578	10,170	94,005	23,022	127,466
	994,607	7,342,488	866,835	7,334,309	1,478,746	12,600,707

TABLE 46.—*Coke imported for consumption in the United States, 1943–45, by countries and customs districts*

	1943		1944		1945	
	Net tons	Value	Net tons	Value	Net tons	Value
COUNTRY						
Canada	97,654	$1,107,499	63,004	$730,650	51,964	$573,389
United Kingdom	473	5,364				
	98,127	1,112,863	63,004	730,650	51,964	573,389
CUSTOMS DISTRICT						
Buffalo	51,562	838,224	23,181	421,160	19,367	320,944
Florida	473	5,364				
Maine and New Hampshire	534	4,837	293	2,768	350	3,147
Montana and Idaho	31,798	192,626	38,345	298,653	30,614	236,808
Ohio					1	7
St. Lawrence	37	498	17	181		
Vermont	573	7,498	98	983	118	1,087
Washington	13,150	63,816	1,070	6,905	1,514	11,396
	98,127	1,112,863	63,004	730,650	51,964	573,389

WORLD PRODUCTION

Data on world production of coke are incomplete because of unsettled conditions throughout the world. Of the five countries whose 1945 output is reported, only Southern Rhodesia showed a gain over the preceding year. An analysis of the major coke-producing countries during the war period indicates that Germany ranked second to the United States in total output. Although figures on German coke production are not available for 1945, output is known to have been only a fraction of what it was before and during the war. Until more complete information is available, production figures for recent years on the world total are meaningless.

COKE-OVEN BYPRODUCTS

SUMMARY OF BYPRODUCTS

In the United States high-temperature carbonization of bituminous coal in byproduct ovens is one of the principal processes for recovering raw materials for the organic chemical industry. Developments in recent years in plastics, synthetic rubber, explosives, dyes, pharmaceutical preparations, and synthetic drugs have emphasized the key importance of benzol, toluol, xylol, naphthalene, phenol, cresylic acid, pyridine, and other chemicals derived from coal carbonization. To the national economy, high-temperature carbonization in byproduct-coke ovens represents an important asset in recovered products essential to the public welfare that would be lost with the use of earlier methods and equipment designed for the recovery of coke only. For example, the value at plant of the chemical raw materials recovered in 1945, which would have been wasted if the coke had been made in beehive ovens, is estimated at more than 223 million dollars; of the products recovered, gas, tar, and light oil have a combined calorific value

TABLE 47.—*Coke produced in principal countries of the world, 1929, 1938, and 1940–45, in metric tons* [1] [2]

[Compiled by B. B. Waldbauer]

Country	1929	1938	1940	1941	1942	1943	1944	1945
Australia:								
New South Wales	471,813	1,153,670	1,292,484	1,738,864	1,644,897	1,592,325	1,402,310	(3)
Queensland	4,144	31,481	21,961	30,991	22,529	15,304	14,637	(3)
Belgium	6,192,960	4,894,980	3,945,280	4,425,180	4,407,080	4,410,940	2,047,290	(3)
Brazil	----------	----------	9,912	21,068	10,267	19,845	(3)	(3)
Bulgaria	----------	3,923	6,000	(3)	(3)	(3)	(3)	(3)
Canada	1,986,532	1,808,588	2,321,775	2,431,942	2,536,165	2,709,354	3,217,107	3,008,050
China	[4] 13,467	[4] 11,630	[4] 18,456	[5] [6] 33,000	[6] 388,734	[6] 379,822	[6] 260,026	(3)
Czechoslovakia	3,170,629	[7] 2,367,000	[8] 2,431,100	[8] 2,334,900	[8] 2,430,000	3,300,000	(3)	(3)
France	9,080,127	7,785,000	5,335,000	(3)	(3)	(3)	2,958,943	2,300,000
Germany [9]	39,421,033	40,404,082	46,931,593	47,636,121	47,996,026	[10] 49,457,000	[10] 49,866,000	(3)
Saar	2,423,000	3,107,000	1,762,293	3,264,830	3,241,439	[10] 3,304,000	[10] 3,534,000	(3)
Great Britain [11]	13,637,421	13,031,396	15,597,384	14,780,479	15,139,145	14,683,955	14,307,360	(3)
Hungary	2,092	53,092	(3)	(3)	(3)	(3)	(3)	(3)
India, British [12]	843,504	1,738,178	1,872,810	1,999,436	1,882,533	1,578,137	(3)	(3)
Indochina	637	3,503	(3)	(3)	(3)	(3)	(3)	(3)
Italy	791,607	1,739,417	1,987,903	1,833,388	1,668,188	2,000,000	(3)	(3)
Mexico	493,777	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Netherlands	2,402,566	3,158,065	2,367,000	(3)	[10] 1,937,000	1,901,000	(3)	(3)
New Caledonia	----------	49,875	69,762	99,700	83,661	(3)	(3)	(3)
Peru	35,899	----------	(3)	(3)	(3)	(3)	(3)	(3)
Poland	1,858,052	2,523,290	(3)	(3)	(3)	2,300,000	(3)	934,400
Rhodesia, Southern	100,001	47,986	[13] 60,238	[13] 68,556	[13] 75,765	[13] 68,658	[13] 75,863	[13] 79,977
Rumania	----------	86,030	(3)	(3)	(3)	80,000	(3)	(3)
Spain	768,040	571,469	839,744	753,108	814,355	801,122	862,574	(3)
Sweden	103,778	112,107	100,753	(3)	(3)	(3)	(3)	(3)
Turkey	----------	84,930	60,192	58,642	81,950	90,000	212,000	(3)
Union of South Africa	99,297	163,315	(3)	(3)	(3)	(3)	(3)	(3)
U. S. S. R.	4,700,000	20,700,000	16,500,000	(3)	[14] 6,085,000	[14] 7,801,000	[14] 9,915,000	(3)
United States	54,325,427	29,479,553	51,774,699	59,135,960	64,018,735	65,023,091	67,165,627	61,060,636
	142,926,000	[15] 135,110,000	[15] 155,306,000	(3)	(3)	(3)	(3)	(3)

[1] Gas-house coke not included.
[2] In addition to countries listed coke is produced in Japan, Korea (Chosen), and New Zealand, but data of production are not available.
[3] Data not available.
[4] Exports.
[5] Production includes State-operated companies only.
[6] Production of Free China.
[7] Excluding Sudetenland since October.
[8] Production of Bohemia and Moravia only.
[9] Beginning October 1939, Silesian production included.
[10] Coal year ended March 31 of year stated.
[11] In Great Britain production of gas-house coke (including breeze), not included, is especially important and was 13,049,139 tons in 1938. Data for 1940–45 not available.
[12] Figures for 1929 represent 73,616 tons of "hard" coke and 769,888 tons of "soft" coke made at collieries only. Data for other years represent total "hard" coke manufactured. In addition, "soft" coke made at collieries was as follows: 1938, 921,479; 1940, 270,135; 1941, 281,071; 1942, 246,648; 1943, 237,397 tons. Data for 1944–45 not available.
[13] Sales of coke by Wankie Colliery for year ended August 31 of year stated.
[14] Production of Urals and Siberia only.
[15] Total incomplete; represents rounded sum of figures given in table only.

equivalent to 16,835,000 tons of coal (table 49). Although the recovery of the valuable byproducts represent, to coke-plant operators, a source of additional revenue and a means of reducing to a minimum conversion costs of coal to coke, the cost of the byproducts cannot be ascertained with any degree of accuracy and, in practice, the revenue derived from them is treated as a deduction from the cost of the main product. It is of interest to note that although coal and manufacturing costs have increased during the war period, prices of the various chemicals have not increased and the values per ton of coke produced have remained relatively stable (table 50). For this reason, the ratio of the total value of byproducts sold (excluding breeze), which was equivalent to 50 percent of the value of byproduct coke produced in 1941, has declined steadily and in 1945 amounted to less than 37 percent. In general, as the recovery of the chemical raw materials necessarily accompanies the production of the main product, the decline in coke production in 1945 substantially reduced the output of all the principal byproducts.

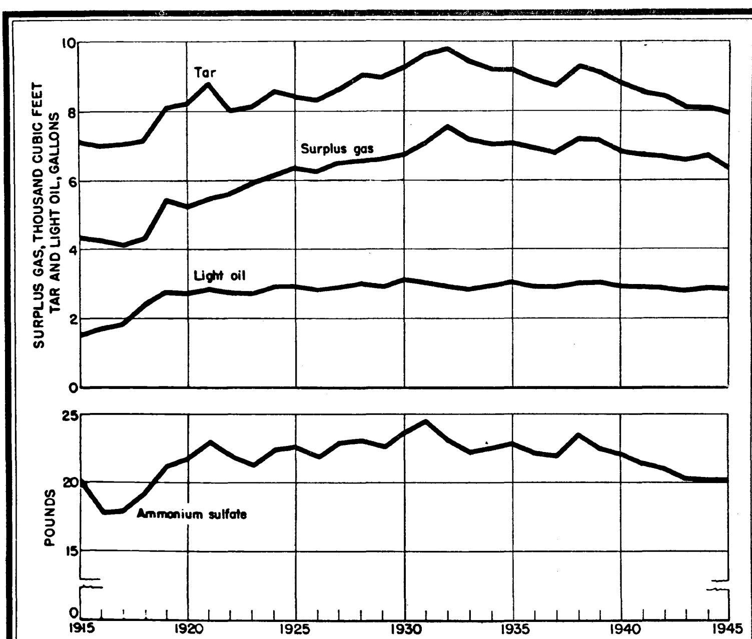

FIGURE 2.—Average yield of principal byproducts per net ton of coal carbonized in byproduct-coke ovens 1915–45. Figures for light oil represent average at plants recovering light oil.

TABLE 48.—*Byproducts obtained from coke-oven operations in the United States in 1945* [1]

[Exclusive of screenings or breeze]

Product	Production	Sales			On hand December 31
		Quantity	Value		
			Total	Average	
Tar ... gallons	696,307,311	410,499,324	$21,827,890	$0.053	30,859,495
Tar derivatives:					
Creosote oil, distillate as such ... do	25,014,189	24,904,234	3,090,841	.124	425,328
Creosote oil in coal-tar solution ... do	11,816,960	10,029,104	1,232,503	.123	563,292
Tar acid oil ... do	13,800,408	13,657,097	1,563,578	.114	747,662
Pitch of tar:					
Soft [2] ... net tons	330,868	8,545	93,293	10.918	10,870
Hard [3] ... do	285,772	------	------	------	499
Other tar derivatives	------	------	1,819,670	------	------
Ammonia:					
Sulfate ... pounds	1,528,585,257	1,602,123,800	20,534,078	.013	64,350,762
Liquor (NH_3 content) ... do	55,213,124	51,439,125	1,556,101	.030	1,907,665
	------	------	22,090,179	------	------
Sulfate equivalent of all forms ... do	1,749,437,753	1,807,880,300	------	------	71,981,422
NH_3 equivalent of all forms ... do	437,359,438	451,970,075	------	------	17,995,356
Gas:					
Used under boilers, etc ... M cubic feet	[4] 904,476,118	32,061,903	3,098,350	.097	------
Used in steel or affiliated plants ... do		324,294,221	36,972,600	.114	------
Distributed through city mains ... do		166,178,374	43,532,085	.262	------
Sold for industrial use ... do		31,718,913	4,141,987	.131	------
	[4] 904,476,118	554,253,411	87,745,022	.158	------
Light oil and derivatives:					
Crude light oil ... gallons	[5] 245,687,253	18,118,822	1,561,237	.086	4,187,551
Benzol:					
Motor ... do	28,788,072	26,044,426	2,236,654	.086	2,851,235
All other grades ... do	126,670,542	122,220,804	15,932,039	.130	6,815,434
Toluol, crude and refined ... do	27,069,321	24,980,173	6,568,730	.263	2,384,031
Xylol, crude and refined ... do	7,504,115	7,480,952	1,930,195	.258	392,358
Solvent naphtha ... do	4,802,748	4,627,715	664,861	.144	316,129
Other light-oil products ... do	7,834,768	5,921,063	555,016	.094	234,753
	[6] 202,669,566	209,393,955	29,448,732	.141	------
Naphthalene, crude ... pounds	87,677,299	86,936,517	1,806,967	.021	2,733,152
Pyridine:					
Crude ... gallons	480,676	429,924	319,361	.743	137,201
Refined ... do	105,865	95,677	326,413	3.412	14,445
Picoline ... do	61,736	40,863	49,686	1.216	44,391
Sodium phenolate ... do	2,576,352	2,580,394	152,974	.059	99,220
Other byproducts [7]	------	------	571,096	------	------
Value of all byproducts sold	------	------	[8] 172,138,205	------	------

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name.
[2] Softening point less than 110° F.
[3] Softening point over 160° F. Includes some medium pitch of tar reported by 1 producer.
[4] Includes gas used for heating ovens and gas wasted.
[5] Refined on premises to make derived products shown: 234,802,231 gallons.
[6] Total gallons of derived products.
[7] Ammonium thiocyanate, cyanogen sludge, dicyclopentadiene, hexane, phenol from sources other than tar distillation, secondary oil, sodium prussiate, sulfur, and vented vapors.
[8] Exclusive of value of breeze production, which was $12,535,373 in 1945.

TABLE 49.—*Coal equivalent of byproducts of byproduct coking in the United States, 1913, 1914, 1918, 1937, and 1944–45*

Year	Quantity of byproducts				Rough equivalent in heating value (billion B. t. u.)					Coal equivalent	
	(1) Coke breeze (thousand net tons)	(2) Surplus gas (billion cubic feet)	(3) Tar produced (thousand gallons)	(4) Light oil produced (thousand gallons)	(5) Coke breeze (1 x 20)	(6) Surplus gas (2 x 550)	(7) Tar (3 x 0.150)	(8) Light oil (4 x 0.130)	(9) Total (5+6+7+8)	(10) Net tons (9÷0.0262)	(11) Percent this forms of coal made into coke
1913	735	64	115, 145	3, 000	14, 700	35, 200	17, 272	390	67, 562	2, 600, 000	3. 8
1914	667	61	109, 901	8, 464	13, 340	33, 550	16, 485	1, 100	64, 475	2, 461, 000	4. 8
1918	1, 999	158	263, 299	87, 562	39, 980	86, 900	39, 495	11, 383	177, 758	6, 785, 000	8. 0
1937	3, 884	463	603, 053	187, 054	77, 680	254, 650	90, 458	24, 317	447, 105	17, 065, 000	22. 9
1944	4, 965	621	767, 807	267, 862	99, 300	341, 550	115, 171	34, 822	590, 843	22, 551, 000	21. 4
1945	4, 629	554	696, 307	245, 687	92, 580	304, 700	104, 446	31, 939	533, 665	20, 369, 000	21. 3

TABLE 50.—*Value of byproducts and of coke, including breeze, per ton of coke produced in the United States, 1937 and 1942–45*

Product	1937	1942	1943	1944	1945
Ammonia and its compounds	$0. 326	$0. 348	$0. 355	$0. 324	$0. 356
Light oil and its derivatives (including naphthalene)	. 435	. 501	. 546	. 552	. 503
Surplus gas sold or used	1. 483	1. 426	1. 390	1. 403	1. 413
Tar sold	. 375	. 388	. 385	. 327	. 352
Miscellaneous products	. 066	. 177	. 178	. 167	. 148
	2. 685	2. 840	2. 854	2. 773	2. 772
Tar used, not sold	. 127	. 085	. 078	. 131	. 095
Breeze produced	. 162	. 175	. 191	. 198	. 202
	2. 974	3. 100	3. 123	3. 102	3. 069
Value of coke produced	5. 026	6. 068	6. 654	7. 140	7. 572
Total value of coke and byproducts	8. 000	9. 168	9. 777	10. 242	10. 641

Gas.—Tables 51 and 52 show the production and disposal of coke-oven gas, by States, in 1945. After increasing continuously during the previous 6 years, production of coke-oven gas declined 10 percent below the record set in 1944. In addition to providing the fuel requirements of the byproduct-coke ovens from which it is produced, coke-oven gas supplies various other fuel needs. In 1945, 61 percent of the total output, a proportion that has changed very little in the past decade, was reported as surplus gas. Of the surplus coke-oven gas used or sold by coke-oven operators, 6 percent was used under boilers, 58 percent in integrated metallurgical works, 6 percent sold to neighboring industries, and 30 percent was sold for distribution through city mains. The quantity of surplus gas declined 11 percent from 1944, with a reduction of 7 percent in value. The average unit values of the surplus gas at plant was $0.158 per M cubic feet compared with $0.152 in 1944.

Crude tar and derivatives.—The cut-back in coke-oven operations in 1945 is reflected in the annual output of crude coal tar, which declined 9 percent below the peak established in 1944. The decreased production was accompanied by decreases in the principal outlets for crude tar. Sales of crude tar by coke-oven operators to other purchasers for refining decreased 2 percent from the 1944 total and accounted for 55 percent of the total production compared with 51 percent in 1944. The quantity processed by the coke-plant operators in integrated tar-refining facilities, which had increased steadily from 1940 to 1944, decreased 11 percent in 1945. Reduced open-hearth operations and the easing of the fuel-oil supply were in a large measure responsible for the decrease of more than 31 percent from 1944 in the quantity of crude tar used by producers in metallurgical operations. With the termination of hostilities in August 1945, Conservation Order M–297 on coal tar was revoked; however, ceiling prices on crude tar established by OPA in 1943 under MPR 447 remained in force throughout the year.

Production of creosote oil, a derivative mainly used for impregnating lumber, decreased 16 percent from 1944, and the value of creosote sold was equivalent to 55 percent of the total revenue received by coke-oven operators from the sale of all tar derivatives. Production of tar-acid oil increased 3 percent, but coal-tar pitch decreased 12 percent from the 1944 figures. Data on phenol, cresols, cresylic acid, and pitch coke cannot be shown separately without revealing individual operations. The total value, however, of sales of these commodities at producing plants amounted to $1,819,670, a decrease of 9 percent from 1944.

Ammonia.—Production of ammonia (NH_3 equivalent of all forms) decreased 7 percent from 1944, a reduction resulting from decreases of 7 and 13 percent, respectively, in output of sulfate of ammonia and ammonia liquor. All but 3 of the 87 active plants in 1945 recovered ammonia, 65 plants made ammonium sulfate, and 22 ammonia liquor (3 plants produced both sulfate and liquor). Approximately 87 percent of the ammonia produced at byproduct-coke plants was converted to ammonium sulfate, the same proportion as in 1944, and the rest recovered as ammonia liquor. Although production of ammonium sulfate decreased in 1945, sales increased 3 percent over 1944. The increase in sales was due to the action taken by the WPB in December 1944, which permitted the fertilizer manufacturers east of the Rocky Mountains an increase of one-twelfth of their original quota. This increase could be taken in January 1945 or, if the buyer preferred, distributed over the first quarter of the year. The price of ammonium sulfate, which has been governed by terms of MPR 205 since August 1942, remained unchanged through the year.

Crude light oil and light-oil derivatives.—Total production of crude light oil in 1945 decreased 22,174,731 gallons or 8 percent from the previous maximum output reported in 1944. The decrease was due in part to coal and steel strikes affecting the industry and also to the decreased yield of light oil per ton of coal carbonized from 2.87 gallons in 1944 to 2.84 gallons. The potential yield of crude light oil per ton of coal carbonized varies widely, depending upon the quality of coal charged, design and conditions of ovens, oven temperatures, coking time, and kind of scrubbing equipment and ranged from less than 2 gallons to more than 4 gallons at several plants in 1945. The bulk of the light oil produced at coke ovens is refined by operators in adjacent refining equipment, and in 1945 more than 95 percent of the total output was processed for the recovery of benzol, toluol, xylol, solvent naphtha, and naphthalene.

Benzol production (all grades), the principal constituent of light oil, decreased 6 percent from 1944 but was 17 percent higher than the prewar total in 1940. It is of interest that the production of "motor benzol," a grade of benzol normally produced for blending with gasoline for use as motor fuel, increased 55 percent over 1944, due to revocation of Conservation Order M–300, which prohibited the use of motor benzol as a motor fuel during the war. Data on the allocation of benzol for the 18-month period, January 1, 1944, to June 30, 1945, are summarized in table 57. This summary of the principal end uses of benzol was prepared by the Bureau of the Census, United States Department of Commerce, from chemical allocation records of the WPB and indicates wartime distribution of benzol. Production and sales of toluol, xylol, and solvent naphtha all decreased compared with 1944.

COKE-OVEN GAS

TABLE 51.—*Coke-oven gas produced and sold in the United States in 1945, by States, in M cubic feet*

State	Active plants	Produced	Used in heating ovens	Surplus sold or used			Wasted
				Quantity	Value		
					Total	Average	
Alabama	7	79,552,354	36,161,661	41,221,472	$3,957,009	$0.096	2,169,221
California	1	4,809,353	378,523	4,262,893	(1)	(1)	167,937
Colorado	1	11,710,300	5,969,041	5,604,299	(1)	(1)	136,960
Illinois	9	50,637,980	15,554,821	34,456,993	4,983,189	.145	626,166
Indiana	5	109,863,899	48,570,762	58,090,465	10,498,633	.181	3,202,671
Maryland	1	26,123,331	9,094,643	16,525,182	(1)	(1)	503.506
Massachusetts	2	17,471,845	3,131,834	14,299,910	(1)	(1)	40,101
Michigan	5	39,006,690	7,127,919	31,651,178	4,388,742	.139	227,563
Minnesota	3	11,783,764	5,037,238	6,707,956	1,703,508	.254	38,570
New Jersey	2	18,845,533	5,396,364	13,449,169	(1)	(1)	----------
New York	8	86,415,834	23,662,378	61,927,500	15,962,824	.258	825,956
Ohio	15	130,253,370	59,393,304	68,753,947	8,770,082	.128	2,106,119
Pennsylvania	13	226,055,874	93,987,886	131,296,276	16,586,744	.126	771,712
Tennessee	1	2,961,525	1,279,644	1,628,946	(1)	(1)	52,935
Texas	1	2,210,790	807,140	1,048,826	(1)	(1)	354,824
Utah	2	15,750,376	4,278,269	10,167,258	(1)	(1)	1,304,849
West Virginia	5	39,335,484	11,502,232	27,657,180	2,429,178	.088	176,072
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	6	31,687,816	5,794,685	25,503,961	5,799,318	.227	389,170
Undistributed	-------	-----------	-----------	-----------	12,665,795	.189	----------
Total, 1945	87	904,476,118	337,128,344	554,253,411	87,745,022	.158	13,094,362
At merchant plants	34	194,283,400	44,328,623	147,480,727	37,699,087	.256	2,474,049
At furnace plants	53	710,192,718	292,799,721	406,772,684	50,045,935	.123	10,620,313
Total, 1944	88	1,008,799,926	373,024,121	621,161,611	94,122,400	.152	14,614,194

[1] Included under "Undistributed."

TABLE 52.—*Disposal of surplus coke-oven gas in the United States in 1945, by States, in M cubic feet*

State	Used by producer—						Sold					
	Under boilers			In steel or other affiliated plants			Distributed through city mains			For industrial purposes		
	Quantity	Value		Quantity	Value		Quantity	Value		Quantity	Value	
		Total	Average		Total	Average		Total	Average		Total	Average
Alabama	7,858,073	$428,206	$0.054	24,296,043	$2,575,546	$0.106	7,812,418	$838,627	$0.107	1,254,938	(1)	(1)
California				4,262,893	(1)	(1)						
Colorado				5,604,299	(1)	(1)						
Illinois	5,826,787	576.989	.099	7,208,475	1,077,620	.149	20,696,942	3,271,352	.158	724,789	(1)	(1)
Indiana	1,887,568	213,369	.113	45,525,612	5,793,856	.127	7,368,054	3,664,309	.497	3,309,231	(1)	(1)
Maryland				9,439,367	(1)	(1)	7,085,815	(1)	(1)			
Massachusetts	7,804	(1)	(1)				14,163,815	(1)	(1)	128,291	(1)	(1)
Michigan	5,052,913	725,769	.144	24,004,059	3,205,089	.134	381,727	(1)	(1)	2,212,479	(1)	(1)
Minnesota	270,237	(1)	(1)	1,792,981	(1)	(1)	4,644,738	(1)	(1)			
New Jersey				333	(1)	(1)	13,448,836	(1)	(1)			
New York	2,328,258	241,585	.104	15,376,025	(1)	(1)	42,137,994	13,471,800	.320	2,085,223	$364,115	$0.175
Ohio	2,645,045	277,284	.105	52,903,986	6,532,906	.123	6,664,185	1,298,910	.195	6,540,731	660,982	.101
Pennsylvania	3,477,704	375,909	.108	99,202,349	10,317,501	.104	18,424,474	4,540,409	.246	10,191,749	(1)	(1)
Tennessee	275,098	(1)	(1)				1,353,848	(1)	(1)			
Texas				1,048,826	(1)	(1)						
Utah	1,239,979	(1)	(1)	8,003,120	(1)	(1)	703,596	(1)	(1)	220,563	(1)	(1)
West Virginia	214,894	15,372	.072	25,625,853	2,240,617	.087				1,816,433	(1)	(1)
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	977,543	101,987	.104				21,291,932	5,479,189	.257	3,234,486	218,142	.067
Undistributed		141,880	.079		5,229,465	.115		10,967,489	.262		2,898,748	.146
Total, 1945	32,061,903	3,098,350	.097	324,294,221	36,972,600	.114	166,178,374	43,532,085	.262	31,718,913	4,141,987	.131
At merchant plants	5,854,028	493,849	.084	10,700,637	1,033,529	.097	113,585,982	33,866,855	.298	17,340,080	2,304,854	.133
At furnace plants	26,207,875	2,604,501	.099	313,593,584	35,939,071	.115	52,592,392	9,665,230	.184	14,378,833	1,837,133	.128
Total, 1944	30,111,380	2,645,851	.088	384.933,114	41,946,422	.109	170,313,905	44,694,854	.262	35,803,212	4,835,273	.135

(1) Included under "Undistributed."

TABLE 53.—*Coke-oven gas and other kinds of gas used in heating ovens in 1945, by States, in M cubic feet*

State	Coke-oven gas	Producer gas [1]	Blue water gas [1]	Blast furnace gas [1]	Other gases [1]	Total coke-oven gas equivalent
Alabama	36,161,661					36,161,661
California	378,523			1,544,585		1,923,108
Colorado	5,969,041					5,969,041
Illinois	15,554,821	956,405		4,289,490	[2] 2,696,862	23,497,578
Indiana	48,570,762		1,002,076		[3] 3,099,447	52,672,285
Maryland	9,094,643			2,122,034		11,216,677
Massachusetts	3,131,834	4,243,102				7,374,936
Michigan	7,127,919	218,126		8,160,071		15,506,116
Minnesota	5,037,238	185,445				5,222,683
New Jersey	5,396,364	2,529,736				7,926,100
New York	23,662,378	11,604,502	967,998	569,490		36,804,368
Ohio	59,393,304			38,527	[2] 48,785	59,480,616
Pennsylvania	93,987,886	1,641,554		1,981,070	[4] 950,957	98,561,467
Tennessee	1,279,644					1,279,644
Texas	807,140			50,476	[2] 23,012	880,628
Utah	4,278,269			2,401,837		6,680,106
West Virginia	11,502,232			2,403,942	[5] 1,746,352	15,652,526
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5,794,685	4,441,118			[6] 3,434,644	13,670,447
	337,128,344	25,819,988	1,970,074	23,561,522	12,000,059	400,479,987
At merchant plants	44,328,623	25,603,072	1,970,074		11,659,240	83,561,009
At furnace plants	292,799,721	216,916		23,561,522	340,819	316,918,978

[1] Corrected to 550 B. t. u. per cubic foot. [2] Natural gas. [3] Propane, butane, and natural gas. [4] Manufactured and oil gas. [5] Spillage gas. [6] Natural gas and natural gasoline.

TABLE 54.—*Coke-oven tar produced, used by producer, and sold in the United States in 1945, by States, in gallons*

State	Produced		Used by producer—				Sold—					On hand Dec. 31
									Total			
										Value		
	Total	Per ton of coal coked	For refining or topping	As fuel under boilers	In open hearth or affiliated plants	Otherwise	For use as fuel [1]	For refining into tar products	Quantity	Total	Average	
Alabama	62,285,739	8.26	2,001,198	296,872	18,544,761	125,051		42,688,330	42,688,330	$2,332,502	$0.055	1,688,034
California	4,604,532	10.48	4,525,521									212,748
Colorado	10,265,000	10.47	10,190,936					160,412	160,412	(2)	(2)	148,201
Illinois	35,546,795	6.84		74,137			6,456,451	29,178,750	35,635,201	1,891,650	.053	1,737,473
Indiana	64,059,230	6.02	15,820,963		5,958,837	2,515,299	4,395,229	35,410,224	39,805,453	2,064,867	.052	3,534,878
Maryland	19,598,426	7.08			1,798,803	1,150		18,046,677	18,046,677	(2)	(2)	1,698,546
Massachusetts	11,885,624	7.33						11,948,234	11,948,234	(2)	(2)	81,308
Michigan	28,734,806	7.31			1,155,642	29,003		28,769,131	28,769,131	1,457,173	.051	1,345,769
Minnesota	8,096,544	7.00			2,300,953	16,500		5,803,197	5,803,197	328,210	.057	664,557
New Jersey	12,267,411	6.81						12,522,703	12,522,703	(2)	(2)	512,000
New York	68,007,060	8.27	18,906,904			24,417	3,962,253	46,021,982	49,984,235	2,718,493	.054	3,063,687
Ohio	93,228,898	7.06	2,124,120	204,112	21,183,447	367,822	10,427,657	59,338,066	69,765,723	3,863,723	.055	4,125,904
Pennsylvania	200,741,617	9.23	125,005,687		45,531,583	550,154	440,766	28,842,437	29,283,203	1,482,057	.051	9,290,348
Tennessee	2,370,908	7.44						2,384,501	2,384,501	(2)	(2)	17,424
Texas	1,683,175	8.35						2,030,508	2,030,508	(2)	(2)	4,000
Utah	15,119,262	11.85			9,059,272	400	101	5,467,720	5,467,821	(2)	(2)	1,178,402
West Virginia	36,087,094	10.27			1,685,540	3,023	945,580	33,498,803	34,444,383	1,908,329	.055	735,986
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	21,725,190	7.28				495		21,759,612	21,759,612	1,102,518	.051	820,230
Undistributed										2,678,368	.051	
Total, 1945	696,307,311	7.95	178,575,329	575,121	107,218,838	3,633,314	26,628,037	383,871,287	410,499,324	21,827,890	.053	30,859,495
At merchant plants	146,388,841	7.81	2,001,198			42,929	243,789	145,305,862	145,549,651	7,376,696	.051	4,613,747
At furnace plants	549,918,470	7.99	176,574,131	575,121	107,218,838	3,590,385	26,384,248	238,565,425	264,949,673	14,451,194	.055	26,245,748
Total, 1944	767,807,171	8.13	200,570,084	862,575	156,735,874	5,165,985	15,851,012	391,338,435	407,189,447	21,897,933	.054	35,043,093

[1] Comprises 4,599,521 gallons of tar sold to affiliated plants and 22,028,516 gallons sold to other purchasers.
[2] Included under "Undistributed."

AMMONIA

TABLE 55.—*Coke-oven ammonia produced and sold in the United States in 1945, by States, in pounds*

State	Active plants	Sulfate equivalent of all forms		Produced as—		Sold as—				On hand Dec. 31	
						Sulfate		Liquor (NH_3 content)			
		Quantity	Per ton of coal coked	Sulfate	Liquor (NH_3 content)	Quantity	Value	Quantity	Value	Sulfate	Liquor (NH_3 content)
Alabama	7	175, 135, 481	23. 22	160, 227, 205	3, 727, 069	162, 362, 226	$2, 221, 804	3, 672, 800	[1]	4, 185, 122	103, 521
California	1	12, 046, 333	27. 41	12, 046, 333	------	12, 060, 300	[1]	------	------	192, 033	------
Colorado	1	21, 857, 026	22. 29	21, 857, 026	------	22, 337, 546	[1]	------	------	851, 000	------
Illinois	9	92, 942, 349	17. 88	88, 154, 241	1, 197, 027	92, 636, 670	1, 159, 717	1, 295, 050	[1]	3, 706, 314	------
Indiana	5	188, 636, 532	17. 74	163, 438, 144	6, 299, 597	166, 807, 119	2, 051, 699	6, 307, 709	$171, 288	10, 509, 474	287, 770
Maryland	1	59, 185, 367	21. 39	59, 185, 367	------	64, 246, 940	[1]	------	------	1, 498, 171	------
Massachusetts	2	27, 831, 500	17. 16	27, 194, 460	159, 260	28, 643, 500	[1]	157, 890	[1]	836, 260	9, 920
Michigan	5	82, 147, 422	20. 91	30, 229, 570	12, 979, 463	30, 158, 710	[1]	10, 880, 501	[1]	500, 800	420, 325
Minnesota	3	20, 034, 400	17. 31	20, 034, 400	------	19, 354, 510	233, 450	------	------	1, 732, 872	------
New Jersey	2	31, 098, 979	17. 27	31, 098, 979	------	31, 981, 570	[1]	------	------	386, 740	------
New York	8	155, 933, 097	18. 96	124, 799, 525	7, 783, 393	135, 251, 765	1, 815, 438	7, 623, 191	236, 701	2, 790, 071	208, 239
Ohio	15	251, 151, 323	19. 03	200, 057, 843	12, 773, 370	196, 886, 847	2, 408, 450	11, 348, 218	350, 912	7, 036, 097	463, 683
Pennsylvania	13	468, 627, 293	21. 55	465, 844, 373	695, 730	514, 084, 388	6, 283, 420	642, 692	[1]	26, 832, 394	36, 688
Tennessee	1	7, 281, 567	22. 84	7, 281, 567	------	7, 101, 400	[1]	------	------	276, 193	------
Texas	1	5, 352. 040	26. 54	5, 352. 040	------	5, 510, 904	[1]	------	------	------	------
Utah	2	32, 802, 374	25. 71	32, 802, 374	------	33, 069, 925	[1]	------	------	668, 538	------
West Virginia	3	59, 298, 655	23. 32	59, 298, 655	------	60, 538, 735	730, 153	------	------	540, 755	------
Connecticut, Kentucky, Missouri, Rhode Island, and Wisconsin	5	58, 076, 015	19. 73	19, 683, 155	9, 598, 215	19, 090, 745	269, 416	9, 511, 074	277, 001	1, 807, 928	377, 519
Undistributed	------	------	------	------	------	------	3, 360, 531	------	520, 199	------	------
Total, 1945	84	1, 749, 437, 753	20. 22	1, 528, 585, 257	55, 213, 124	1, 602, 123, 800	20, 534, 078	51, 439, 125	1, 556, 101	64, 350, 762	1, 907, 665
At merchant plants	31	350, 299, 660	19. 75	211, 597, 728	34, 675, 483	215, 704, 335	2, 982, 124	37, 774, 470	1, 125, 818	7, 210, 067	1, 204, 235
At furnace plants	53	1, 399, 138, 093	20. 34	1, 316, 987, 529	20, 537, 641	1, 386, 419, 465	17, 551, 954	13, 664, 655	430, 283	57, 140, 695	703, 430
Total, 1944	85	1, 889, 806, 197	20. 29	1, 636, 487, 509	63, 329, 672	1, 553, 923, 139	19, 828, 483	60, 008, 642	1, 914, 785	138, 061, 389	1, 697, 337

[1] Included under "Undistributed."

LIGHT OIL AND ITS DERIVATIVES

TABLE 56.—*Coke-oven crude light oil produced in the United States and derived products obtained and sold in 1945, by States, in gallons*

State	Active plants	Produced: Total	Produced: Per ton of coal coked	Refined on premises [1]	Derived products obtained and sold: Produced	Derived products obtained and sold: Sold [2] Quantity	Derived products obtained and sold: Sold [2] Value	On hand Dec. 31
Alabama	7	21,275,658	2.82	21,087,679	18,381,092	16,859,290	$2,364,901	289,238
California	1	1,477,559	3.36	1,476,253	1,192,074	1,152,931	(3)	11,376
Colorado	1	3,215,085	3.28	3,206,376	3,045,833	2,861,180	(3)	445
Illinois	7	13,081,796	2.65	9,308,959	7,894,653	7,454,874	1,102,446	167,043
Indiana	5	26,912,100	2.53	28,692,803	25,272,245	23,628,984	3,375,649	318,847
Maryland	1	10,995,394	3.97	10,981,180	9,163,307	8,386,047	(3)	76,358
Michigan	4	11,007,280	2.83	5,253,976	4,437,183	4,347,837	(3)	541,848
New York	8	21,353,526	2.60	32,546,675	28,203,554	27,578,026	4,089,353	269,226
Ohio	15	36,633,837	2.78	30,739,880	24,692,936	23,016,395	3,297,345	470,198
Pennsylvania	13	65,619,481	3.02	63,838,220	56,144,730	54,358,209	7,783,507	1,283,894
Tennessee	1	811,885	2.55	809,793	729,791	544,219	(3)	8,515
Texas	1	498,095	2.47	498,095	475,602	500,411	(3)	---------
Utah	2	5,516,805	4.32	5,510,586	4,333,120	4,218,050	(3)	171,297
West Virginia	5	12,198,955	3.47	10,564,922	9,947,613	8,054,437	1,273,220	231,299
Connecticut, Kentucky, Massachusetts, Minnesota, Missouri, New Jersey, and Wisconsin	9	15,089,797	2.20	10,286,834	8,755,833	8,314,243	1,252,456	347,967
Undistributed	--------	----------	--------	-----------	----------	----------	3,348,618	---------
Total, 1945	80	245,687,253	2.84	234,802,231	202,669,566	191,275,133	27,887,495	4,187,551
At merchant plants	28	42,316,584	2.35	40,285,849	35,216,206	32,698,414	4,772,420	1,227,811
At furnace plants	52	203,370,669	2.97	194,516,382	167,453,360	158,576,719	23,115,075	2,959,740
Total, 1944	81	267,861,984	2.87	[4] 258,044,532	222,436,683	215,609,266	33,100,221	3,483,337

[1] Comprises 226,416,224 gallons of crude light oil made on premises and 8,386,007 gallons purchased from other coke-oven plants.
[2] Excludes 18,118,822 gallons of crude light oil valued at $1,561,237 sold as such.
[3] Included under "Undistributed."
[4] Revised figure.

TABLE 57.—*Allocations of benzene, Jan. 1, 1944–June 30, 1945*

[Thousands of gallons]

	Total		January 1–June 30, 1945	July 1–December 31, 1944	January 1–June 30, 1944
	Amount	Percent			
Aviation gasoline [1]	175,630	47.1	45,707	71,746	58,177
Styrene	80,561	21.7	30,830	27,431	22,300
Phenol	39,911	10.7	14,422	12,114	13,375
Aniline	22,208	6.0	9,374	6,768	6,066
Chlorobenzene	9,403	2.5	3,982	3,208	2,213
Solvents	8,124	2.2	2,446	3,170	2,508
Diphenyls	3,574	1.0	981	1,161	1,432
Medicinals	2,100	.6	608	770	722
Solvent blends [2]	1,376	.4	643	733	
Nitrobenzene	1,618	.4	401	507	710
Rubber chemicals	937	.3	347	290	300
Trichlorobenzene	246	.1	74	98	74
Miscellaneous uses [3]	24,202	6.5	8,834	7,613	7,755
	369,890	99.5	118,649	135,609	115,632
Direct military [4]	1,868	.5	42	638	1,188
Foreign	88	(5)	23	20	45
	371,846	100.0	118,714	136,267	116,865

[1] Includes military aviation fuel.
[2] Blends as defined and controlled by Order M-150.
[3] Includes benzene used in the manufacture of nylon, phthalate plasticizers, maleic anhydride, camphor, anthraquinone, resorcinol, alcohol denaturant, small orders, and other miscellaneous uses not specified. Quantities used in nylon comprise a substantial part of this total. No benzene was allocated for the manufacture of automotive fuel during this period.
[4] End-use data not available.
[5] Less than 0.05 percent.

NAPHTHALENE

TABLE 58.—*Crude naphthalene produced and sold by byproduct-coke-oven operators in the United States, 1941–45*

Year	Produced (pounds)	Sold			Receipts per ton of coke (cents)
		Pounds	Value		
			Total	Average per pound (cents)	
1941	84,046,676	83,879,396	$1,522,518	$0.018	$0.026
1942	95,612,788	95,039,639	1,941,626	.020	.031
1943	98,096,899	98,031,058	2,088,829	.021	.033
1944	103,041,023	103,839,789	2,094,596	.020	.031
1945	87,677,299	86,936,517	1,806,967	.021	.029

BYPRODUCT-COKE OVENS OWNED BY CITY-GAS COMPANIES (PUBLIC UTILITY PLANTS)

For many years the Bureau of Mines has maintained a separate classification for that group of byproduct-coke plants owned by city-gas companies (public utility plants). From the point of view of ownership and accounting these installations are part of the gas utility system; however, when considered with reference to oven design and the technique of manufacture and still more with reference to supply and demand for coke, these ovens belong to the byproduct-coke industry and are therefore included in the statistics furnished by the Bureau of Mines. This classification is maintained in the interest of those who may want to obtain information on the byproduct-coking operations of city-gas works proper.

During 1945, 15 byproduct-coke plants owned by city-gas companies operated and contributed approximately 6 percent of the total output of coke, tar, and gas of the byproduct-coke industry, 5 percent of the ammonia (NH_3 equivalent of all forms), and about 3 percent of the crude light oil. In 1945, production of coke and byproducts from this group declined for the second consecutive year, and output of coke decreased 7 percent, gas 8 percent, crude tar 9 percent, and ammonia 10 percent from the 1944 figures.

The following table presents salient statistics for 1944 and 1945 of the city-gas byproduct-coke plants in relation to the industry as a whole.

TABLE 59.—*Production of coke, breeze, gas, and byproducts in the United States at byproduct-coke plants owned by city-gas companies (public utilities* [1]*) and at all other byproduct-coke plants, 1944–45*

Product	1944			1945		
	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total
Number of active plants	73	15	88	72	15	87
Coke:						
Production ..... net tons	63, 123, 534	3, 941, 261	67, 064, 795	58, 430, 076	3, 664, 212	62, 094, 288
Value	$444, 655, 387	$34, 188, 785	$478, 844, 172	$437, 080, 202	$33, 110, 137	$470, 190, 339
Average per ton	$7. 04	$8. 67	$7. 14	$7. 48	$9. 04	$7. 57
Screenings or breeze:						
Production ..... net tons	4, 616, 609	348, 455	4, 965, 064	4, 277, 316	351, 217	4, 628, 533
Sales ..... do	989, 174	28, 973	1, 018, 147	1, 061, 082	27, 808	1, 088, 890
Value	$3, 158, 350	$85, 778	$3, 244, 128	$2, 908, 281	$90, 145	$2, 998, 426
Average per ton	$3. 19	$2. 96	$3. 19	$2. 74	$3. 24	$2. 75
Coal charged into ovens:						
Bituminous ..... net tons	(2)	(2)	(2)	82, 069, 793	5, 144, 370	87, 214, 163
Anthracite ..... do	(2)	(2)	(2)	285, 686	36, 915	322, 601
Total ..... do	88, 891, 035	5, 546, 852	94, 437, 887	82, 355, 479	5, 181, 285	87, 536, 764
Value	$445, 972, 068	$34, 225, 442	$480, 197, 510	$429, 455, 738	$33, 039, 337	$462, 495, 075
Average per ton	$5. 02	$6. 17	$5. 08	$5. 21	$6. 38	$5. 28
Coke—						
Used by producer:						
Net tons	39, 416, 669	1, 272, 034	40, 688, 703	35, 840, 503	1, 329, 067	37, 169, 570
Value	$272, 972, 118	$8, 818, 105	$281, 790, 223	$266, 844, 670	$9, 454, 255	$276, 298, 925
Sold:						
Net tons	23, 447, 528	2, 583, 902	26, 031, 430	22, 557, 426	2, 379, 182	24, 936, 608
Value	$169, 546, 156	$24, 612, 363	$194, 158, 519	$169, 949, 107	$24, 066, 683	$194, 015, 790
Byproducts:						
Tar:						
Production ..... gallons	719, 144, 950	48, 662, 221	767, 807, 171	652, 106, 266	44, 201, 045	696, 307, 311
Sales ..... do	358, 406, 879	48, 782, 568	407, 189, 447	366, 043, 225	44, 456, 099	410, 499, 324
Value	$19, 280, 968	$2, 616, 965	$21, 897, 933	$19, 476, 954	$2, 350, 936	$21, 827, 890
Ammonia:						
Production (NH_3 equivalent of all forms) pounds	447, 222, 749	25, 228, 800	472, 451, 549	414, 637, 421	22, 722, 017	437, 359, 438
Liquor (NH_3 content):						
Production ..... do	58, 166, 748	5, 162, 924	63, 329, 672	50, 801, 127	4, 411, 997	55, 213, 124
Sales ..... do	54, 910, 512	5, 098, 130	60, 008, 642	47, 054, 833	4, 384, 292	51, 439, 125
Value	$1, 785, 452	$129, 333	$1, 914, 785	$1, 453, 291	$102, 810	$1, 556, 101
Sulfate:						
Production ..... pounds	1, 556, 224, 007	80, 263, 502	1, 636, 487, 509	1, 455, 345, 178	73, 240, 079	1, 528, 585, 257
Sales ..... do	1, 476, 390, 430	77, 532, 709	1, 553, 923, 139	1, 526, 866, 800	75, 257, 000	1, 602, 123, 800
Value	$18, 760, 775	$1, 067, 708	$19, 828, 483	$19, 491, 616	$1, 042, 462	$20, 534, 078

See footnotes at end of table.

TABLE 59.—*Production of coke, breeze, gas, and byproducts in the United States at byproduct-coke plants owned by city-gas companies (public utilities* [1]*) and at all other byproduct-coke plants, 1944–45*—Continued

Product	1944			1945		
	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Total	Plants not owned by city-gas companies	Plants owned by city-gas companies (public utilities)	Tota
Byproducts—Continued						
Gas:						
Production M cubic feet	947,353,784	61,446,142	1,008,799,926	847,848,089	56,628,029	904,476,118
Disposal of surplus:						
Used under boilers:						
M cubic feet	30,098,580	12,800	[3] 30,111,380	32,017,600	44,303	32,061,903
Value	$2,641,817	$4,034	$2,645,851	$3,092,247	$6,103	$3,098,350
Average per M cubic feet	$0.088	$0.315	$0.088	$0.097	$0.138	$0.097
Used in steel or affiliated plants:						
M cubic feet	384,933,114		384,933,114	324,241,986	52,235	324,294,221
Value	$41,946,422		$41,946,422	$36,952,380	$20,220	$36,972,600
Average per M cubic feet	$0.109		$0.109	$0.114	$0.387	$0.114
Distributed through city mains:						
M cubic feet	116,853,680	53,460,225	170,313,905	114,960,028	51,218,346	166,178,374
Value	$27,209,528	$17,485,326	$44,694,854	$26,110,110	$17,421,975	$43,532,085
Average per M cubic feet	$0.233	$0.327	$0.262	$0.227	$0.340	$0.262
Sold for industrial use:						
M cubic feet	31,677,493	4,125,719	35,803,212	29,102,560	2,616,353	31,718,913
Value	$3,443,679	$1,391,594	$4,835,273	$3,236,809	$905,178	$4,141,987
Average per M cubic feet	$0.109	$0.337	$0.135	$0.111	$0.346	$0.131
Crude light oil:						
Production gallons	259,140,334	8,721,650	267,861,984	237,439,484	8,247,769	245,687,253
Sales do	16,907,317	4,965,049	21,872,366	13,822,705	4,296,117	18,118,822
Value	$1,418,278	$399,526	$1,817,804	$1,230,003	$331,234	$1,561,237
Light oil derivatives:						
Production gallons	218,563,989	3,872,694	222,436,683	198,864,848	3,804,718	202,669,566
Sales do	211,799,325	3,809,941	215,609,266	187,587,304	3,687,829	191,275,133
Value	$32,653,776	$446,445	$33,100,221	$27,468,672	$418,823	$27,887,495
Naphthalene, crude:						
Production pounds	102,174,677	866,346	103,041,023	86,898,339	778,960	87,677,299
Sales do	102,947,593	892,196	103,839,789	86,157,557	778,960	86,936,517
Value	$2,077,968	$16,628	$2,094,596	$1,791,522	$15,445	$1,806,967
All other byproducts, value	$11,145,251	$73,769	$11,219,020	$9,159,124	$60,291	$9,219,415

[1] Byproduct ovens built by city-gas companies, some of which are operated in conjunction with coal-, oil-, and water-gas plants. Does not include independent byproduct plants, which may sell gas to public utility companies for distribution.
[2] Not separated into bituminous and anthracite.
[3] Revised figure.

FUEL BRIQUETS AND PACKAGED FUEL[1]

By Gertrude S. Goodman

SUMMARY OUTLINE

SUMMARY

Despite 1945 shortages in the supply of labor, raw fuels, and other materials, the fuel-briquetting industry has continued steady expansion of its production since 1938. Output in 1945 reached a total of 2,762,204 net tons—73 percent of the total capacity of the 32 plants in operation. Packaged-fuel production, after 4 years of steadily declining output, began to recover in 1945, rising to 208,143 tons with 61 plants in operation.

Wartime controls by the War Production Board (now Civilian Production Administration)[2] were generally dropped after cessation of hostilities in August 1945; however, the Mining Division of CPA is still offering industry limited priority assistance to obtain machinery urgently needed to avoid bottlenecks in production.

The program inaugurated in 1944 by the Solid Fuels Administration for War[3] for the wider utilization of surplus anthracite fines in the manufacture of fuel briquets and packaged fuel to alleviate the shortage of scarce bituminous coals continued effective in 1945, and close to a million tons of Pennsylvania anthracite fines were used in the manufacture of fuel briquets and packaged fuel in that year. Practically all Federal restrictions on coal ordered by the Solid Fuels Administration for War were removed by April 1, 1946.[4]

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.
Data on employment and principal expenses in the manufacture of fuel briquets may be obtained from the Bureau of the Census.
Briquets made from charcoal, wood scrap, and fruit pits are not included in Bureau of Mines review.
Records on fuel briquets collected since 1907 and on packaged fuel since 1935 published in earlier reports of this series.
[2] American Mining Congress Bulletin Service, CPA Mining Branch: No. 47, Nov. 23, 1945, p. 5; Mining Machinery: No. 1, Jan. 8, 1946, p. 4.
[3] Solid Fuels Administration for War, P. N. 71018, SFA 254, Sept. 5, 1944.
[4] American Mining Congress Bulletin Service, SFA Controls: No. 5, Feb. 16, 1946, p. 6. Saward's Journal, Lignite Exempted from SFAW Regulations: Vol. 28, No. 13, June 30, 1945, p. 156.

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Price control by the Office of Price Administration remained effective throughout 1945 and served to prevent repetition of the high briquet prices of World War I.[5]

Technologic developments.—Under cooperative agreement between the Bureau of Mines and the University of West Virginia, laboratories will be provided by the University at Morgantown and staffed by Bureau of Mines personnel for experiments as part of the 5-year synthetic liquid-fuels program authorized by the 78th Congress. The briquetting and coking section of the laboratory will investigate coal briquetting, carbonization, oxidation, cleaning, and other pretreatment methods in an effort to prepare a suitable low-cost fuel for generating the gases needed in the production of synthetic oil and gasoline.[6]

Work on the Piersol[7] process and press installed at the Applied Research Laboratory of the Illinois Geological Survey at Urbana, Ill., for briquetting Illinois coals was continued in 1945 with further experiments on contour of the briquet and metallurgical composition of briquetting dies.

A new development in the Piersol process consists of making briquets at room temperature from minus 10-mesh Illinois coals on the commercial-scale press without binder at approximately 30,000 pounds per square inch, followed by a 1-hour heat treatment at about 360° C. to render the briquets smokeless and weather-resistant.[8]

Illinois high-volatile bituminous coals have been successfully used in making fuel briquets since 1941 by the Coal Processing Corp. at Buckner, Ill., and were also used by the Super Heat Fuel Co., which started operations in December 1945. Tests on briquetting Illinois coals are also being conducted by several companies in the Middle West which may lead to commercial operations.

Outlook.—As the demand for fuel briquets and packaged fuel in recent years has generally exceeded the supply, it is reasonable to assume that production of these fuels will continue to increase. Two large new plants of the Reading Briquet Co.[9] in Pennsylvania expect to start operations in 1946, and interest in briquetting is spreading in other sections of the United States.

The packaged-fuel industry—relatively young and comprising many small operations—was unable to successfully weather the reverses of 4 years of shortages of labor and critical materials caused by the war. However, packaged fuel has definitely demonstrated its popularity and achieved a permanent place in the consumer fuel market. Production in 1945 has already taken an upward turn, and further expansion of the market was the objective of discussions at the meeting of the National Association of Packaged Fuel Manufacturers in Chicago on June 12, 1945.[10]

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[5] Goodman, G. S., Fuel Briquets and Packaged Fuel: Minerals Yearbook, 1943, p. 1041.

[6] U. S. Department of the Interior, P. N. 120267, Nov. 2, 1945.

[7] Piersol, R. J., Briquetting Illinois Coals Without a Binder by Compression and Impact: Illinois State Geol. Survey Rept. of Investigations 31, 1933, 70 pp.; Briquetting Illinois Coals Without a Binder by Impact: Illinois State Geol. Survey Rept. of Investigations 37, 1935, 75 pp.; Smokeless Briquets: Impacted Without Binder from Partially Volatilized Illinois Coal: Illinois State Geol. Survey Rept. of Investigations 41, 1936, 30 pp.

[8] Data from April 1946 correspondence with Dr. M. M. Leighton, chief, State Geological Survey Division, Urbana, Ill.

[9] Saward's Journal, Briquet Plants to be Finished: Vol. 28, No. 21, Aug. 25, 1945, p. VI; Briquet Plant Nearly Ready: Vol. 28, No. 34, Nov. 24, 1945, p. 398. Coal Age, P. & R. Briquet Plant Starts Output: Vol. 51, No. 3, March 1946, pp. 144, 146.

[10] Saward's Journal, Packaged Fuel Manufacturers Meet: Vol. 28, No. 11, June 16, 1945, p. 132.

FUEL BRIQUETS

Salient statistics of the fuel-briquetting industry from 1941 to 1945 are summarized in the following table. Production and value from 1917 to 1945, inclusive, are shown graphically in figure 1.

Production.—The output of fuel briquets in 1945, continuing its upward trend, reached a total of 2,762,204 tons valued at $21,678,-886—a 12-percent increase in tonnage and an 18-percent increase in value over 1944.

Production rose to 73 percent of the capacity of the 32 plants active in 1945, reported as approximately 3,783,000 tons (see capacity

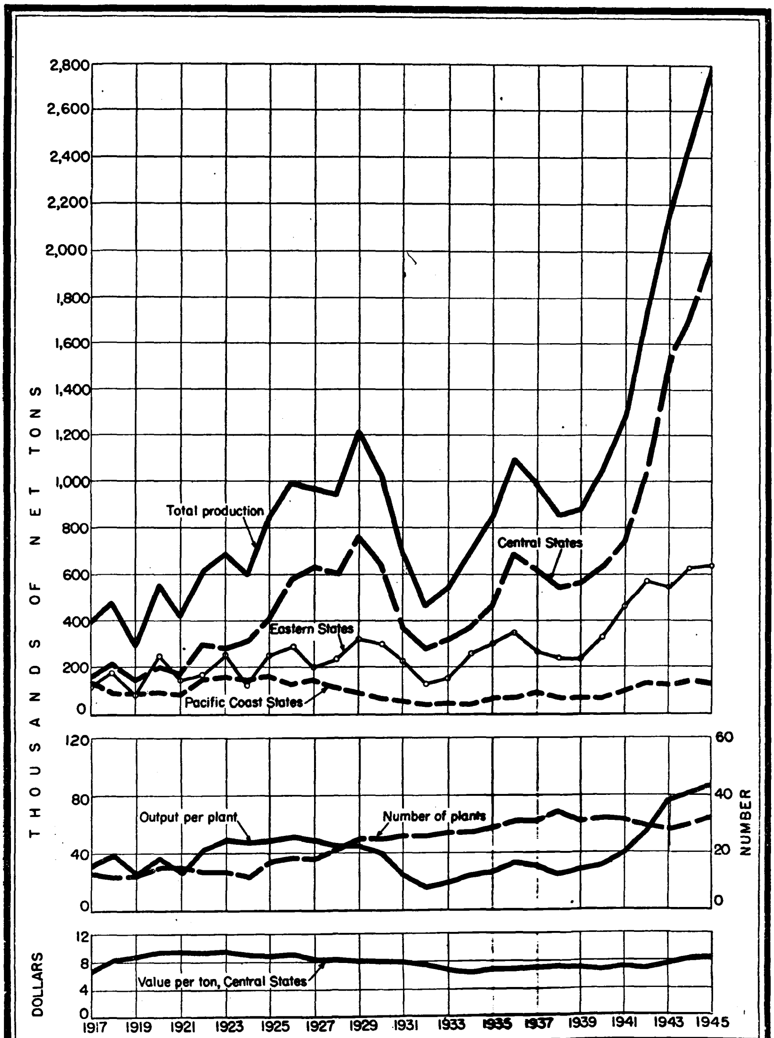

FIGURE 1.—Production of fuel briquets, output per plant, and number of plants in operation in the United States and average value per net ton, f. o. b. plant (Central States), 1917–45.

Salient statistics of the fuel-briquetting industry in the United States, 1941–45

[Data regarding packaged fuel are given separately at end of this chapter]

Year	Production				Imports	Exports
	Eastern States	Central States	Pacific Coast States	Total		
	Net tons					
1941	457,511	751,801	89,294	1,298,606	162	40,477
1942	565,675	1,047,747	134,878	1,748,300	334	103,921
1943	544,786	1,493,368	125,844	2,163,998	198	174,973
1944	625,779	1,704,005	135,177	2,464,961	538	163,672
1945	637,740	1,991,733	132,731	2,762,204	722	174,107

Year	Consumption [1] (net tons)	Value of production	Plants in operation	Average output per plant (net tons)	Average value per net ton, f. o. b. plant		
					Eastern States	Central States	Pacific Coast States
1941	1,258,291	$8,001,829	32	40,581	$4.21	$7.09	$8.36
1942	1,644,713	11,266,041	30	58,277	4.56	7.04	9.69
1943	1,989,223	15,148,109	28	77,286	5.04	7.44	10.26
1944	2,301,827	18,434,579	30	82,165	5.42	8.03	10.07
1945	2,588,819	21,678,886	32	86,319	5.65	8.40	10.04

[1] Production plus imports minus exports.

analysis for 1944–45 in following pages). Briquets were made in 15 States in 1945, with production centered in Wisconsin (leading with 1,486,515 tons), followed by West Virginia, Pennsylvania, and Missouri, in order.

Production cannot be shown by States without revealing the operations of individual plants, except for Wisconsin, Missouri, and Illinois, as there were less than 3 plants in each of the other 12 producing States. In 1945, for the first time on record, there were 3 plants in operation in Illinois, producing 117,229 tons valued at $512,692.

Production of fuel briquets in the United States, 1944–45

	1944			1945				
	Plants	Net tons	Value	Plants	Net tons	Value	Change in 1945, percent	
							Tonnage	Value
Eastern States	5	625,779	$3,393,595	5	637,740	$3,606,372	+1.9	+6.3
Central States	22	1,704,005	13,680,036	24	1,991,733	16,739,912	+16.9	+22.4
Pacific Coast States	3	135,177	1,360,948	3	132,731	1,332,602	−1.8	−2.1
	[1] 30	2,464,961	18,434,579	[1] 32	2,762,204	21,678,886	+12.1	+17.6

[1] 1944: 10 plants in Wisconsin; 3 in Missouri; 2 each in Illinois, Michigan, Pennsylvania, and West Virginia; and 1 each in Arkansas, California, Massachusetts, Minnesota, Nebraska, North Dakota, Oregon, Washington, and Wyoming; 1945: 11 plants in Wisconsin; 3 each in Illinois and Missouri; 2 each in Michigan, Pennsylvania, and West Virginia; and 1 each in Arkansas, California, Massachusetts, Minnesota, Nebraska, North Dakota, Oregon, Washington, and Wyoming.

Production of fuel briquets in Wisconsin, 1940–45

Year	Plants	Net tons	Value	Year	Plants	Net tons	Value
1940	11	487,574	$3,440,676	1943	10	1,070,857	$8,228,671
1941	10	535,457	3,870,077	1944	10	1,208,147	10,074,381
1942	10	750,417	5,498,748	1945	11	1,486,515	12,889,487

Production of fuel briquets in Missouri, 1942–45

Year	Plants	Net tons	Value
1942	3	104,415	$589,466
1943	3	188,736	1,236,829
1944	3	252,286	1,910,384
1945	3	269,068	2,199,523

As briquets are used almost entirely for space heating, production is normally highly seasonal; however, since 1942 the monthly output throughout each year has been maintained at a high level. In 1945, 24 of the 32 active plants operated every month; only 3 plants operated less than 8 months and one of these was a new plant in Illinois which started operations in December. According to the Weather Bureau,[11] 1945 was notable for severe cold weather which is reflected in the increased shipments [12] to the briquet-consuming States, particularly Minnesota, Wisconsin, and the Dakotas.

Monthly production of fuel briquets in the United States, 1943–45, in net tons

Month	1943	1944	1945	Month	1943	1944	1945
January	187,201	202,234	260,340	August	204,424	222,081	235,629
February	192,201	205,879	235,121	September	205,979	222,223	238,776
March	188,500	181,137	208,337	October	205,118	239,687	259,831
April	133,531	152,725	174,613	November	179,564	240,925	257,427
May	121,027	192,944	208,452	December	204,299	233,667	256,719
June	153,854	192,427	227,892				
July	188,300	179,032	199,067		2,163,998	2,464,961	2,762,204

Packaging in cartons and bagging of bulk briquets at the plants, reported by seven operators, are merchandizing features only, used for convenience and cleanliness in the delivery of the fuel. One operator, however, reported wrapping several hundred tons of cubes—a small part of his total production—in 10-pound packages suitable for burning in the package if desired.

Value.—As sales realizations on briquets in the scattered producing centers vary considerably, an average value per ton for the entire industry has doubtful significance, because of the different conditions under which briquets are manufactured and sold. The most important factors that influence the value per ton realized at any plant are cost of raw materials and labor and prices of competing fuels; hence, the trend of fuel-briquet values in the past 5 years is indicated best in this review by the average values in the Eastern, Central,

[11] Baldwin, J. L., The Weather of 1945 in the United States: U. S. Dept. of Commerce Monthly Weather Review, vol. 73, No. 12, December 1945, pp. 201–205.
[12] See following table for "Shipments of fuel briquets of domestic manufacture in the United States, 1944–45, by States of destination, as reported by producers, in net tons."

and Pacific Coast States, as shown in the last three columns of the table of salient statistics. These are the values received by producers for the total product at the plant and should not be confused with retail prices which may include transportation costs to markets and wholesalers' margins. Retail prices paid by consumers in certain cities are shown in a separate table.

The total value of fuel briquets manufactured in 1945 was $21,678,886, f. o. b. plant—an increase of $3,244,307 or 17.6 percent over 1944.

Prices.—The following monthly fuel-briquet prices available for 15 cities for 1945 represent cash sales to household consumers for 1-ton lots (2,000 pounds) delivered at the curb or into the bin if no extra charge is made. Taxes are included when applicable. The monthly periods covered extend from the fifteenth of one month to the fifteenth of the succeeding month. The changes in prices during the year generally reflect local adjustment to ceilings allowed by OPA to partly compensate for higher costs of production including the increase in miners' wages.

Retail fuel-briquet prices per net ton in 1945, by cities and months

[Source: Bureau of Labor Statistics, U. S. Department of Labor]

City	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Baltimore, Md	$11.34	$11.59	$11.59	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34	$11.34
Boston, Mass	14.34	14.59	14.59	14.34	14.34	14.34	14.34	14.34	14.34	14.34	14.34	14.34
Charleston, S. C	14.25	14.25	14.31	14.31	14.31	14.31	14.38	14.38	14.38	14.38	14.38	14.38
Chicago, Ill.[1]	12.97	12.97	12.97	12.97	13.15	13.15	13.14	13.17	13.17	13.17	13.17	13.17
Cincinnati, Ohio[2]	10.07	10.07	10.07	10.07	10.48	10.48	10.48	10.56	10.56	10.56	10.56	10.56
Columbus, Ohio[2]	10.42	10.42	10.42	10.42	10.68	10.68	10.68	10.70	10.86	10.86	10.73	10.73
Fall River, Mass	14.35	14.35	14.44	14.39	14.34	14.34	14.34	14.34	14.34	14.34	14.34	14.34
Kansas City, Mo.[1]	12.01	12.01	12.01	12.01	12.83	12.83	12.83	12.83	12.83	12.83	12.83	12.83
Louisville, Ky	9.48	9.48	9.54	9.67	9.68	9.80	9.87	9.88	9.88	9.89	9.89	9.89
Milwaukee, Wis	12.88	12.88	12.90	12.90	12.90	12.98	13.08	13.08	13.13	13.13	13.13	13.13
Minneapolis, Minn	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.59	14.59	14.59	14.59	14.59
Norfolk, Va	12.15	12.15	12.15	12.15	12.65	12.65	12.65	12.70	12.70	12.70	12.70	12.70
St. Louis, Mo.[1]	11.76	11.76	11.76	11.80	11.89	11.97	11.99	11.99	12.01	12.06	12.06	12.06
St. Paul, Minn	14.34	14.34	14.34	14.34	14.34	14.34	14.34	14.58	14.58	14.58	14.58	14.58
Washington, D. C.[3]	10.93	10.93	10.93	10.76	10.98	10.98	11.08	11.08	11.08	11.08	11.08	11.12

[1] Includes 2 percent sales tax.
[2] Includes 3 percent sales tax.
[3] Since April 1, 1945, briquets in Washington, D. C., sold on net-ton basis of 2,000 pounds; January, February, and March gross-ton price of $12.24 changed to a net-ton basis to make prices comparable throughout year.

Number of plants.—Thirty-two briquetting plants reported production in 1945; 23 of these have been active every year for periods of 7 to 37 years. Plants operating every year for more than 30 years are: Universal Coal Washing Co., Lessee, Kansas City, Mo., 37 years; Stott Briquet Co., at Superior, Wis., 37 years; Berwind Fuel Co., at Superior, Wis., 34 years; and Portland Gas & Coke Co., at Portland, Oreg., 33 years.[13]

Five plants were idle in 1945—one each in Minnesota and Connecticut, idle for 7 years or more; one each in Ohio and Texas, idle since 1941, when a small production was reported; and one in North Dakota—the plant of Western Carbon & Chemical, Inc., at Minot, reported under construction in 1944.

[13] Years other plants (active in 1945) started producing are given in the 1945 Fuel-Briquet Directory, obtainable on request from the Bureau of Mines, Washington 25, D. C.

Annual capacity and production of active briquetting plants in the United States, 1944–45

	1944					1945				
	Active plants		Production			Active plants		Production		
				Percent of—					Percent of—	
	Number	Annual capacity (net tons)	Net tons	Annual capacity	Annual production	Number	Annual capacity (net tons)	Net tons	Annual capacity	Annual production
Capacity of—										
Less than 5,000 tons	1	15,000	4,109	27.4	0.2	1	15,000	3,863	25.8	0.2
5,000 and less than 10,000	[1]2					2				
10,000 and less than 25,000	6	89,500	50,727	56.7	2.0	[2]6	85,500	45,105	52.8	1.6
25,000 and less than 100,000	[3]9	495,500	330,562	66.7	13.4	[1]10	461,000	267,982	58.1	9.7
100,000 and less than 200,000	7	883,900	774,130	87.6	31.4	8	996,400	895,399	89.9	32.4
200,000 and less than 400,000	2	2,010,000	1,305,433	64.9	53.0	2	2,225,000	1,549,855	69.7	56.1
400,000 tons or more	3					3				
	30	3,493,900	2,464,961	70.6	100.0	32	3,782,900	2,762,204	73.0	100.0
Production of—										
Less than 2,000 tons	[1,3]3	63,000	9,446	15.0	.4	[2]3	29,000	1,963	6.8	.1
2,000 and less than 5,000	2					3	48,000	9,733	20.3	.3
5,000 and less than 10,000	3	36,000	21,557	59.9	.9	[1]3	82,000	18,501	22.6	.7
10,000 and less than 25,000	3	84,500	47,229	55.9	1.9	6	152,500	103,949	68.2	3.8
25,000 and less than 100,000	11	836,500	643,138	76.9	26.1	8	650,000	508,723	78.3	18.4
100,000 tons or more	8	2,473,900	1,743,591	70.5	70.7	9	2,821,400	2,119,335	75.1	76.7
	30	3,493,900	2,464,961	70.6	100.0	32	3,782,900	2,762,204	73.0	100.0

[1] 1 of these plants operated only 3 months of the year.
[2] 1 of these plants started operations in December 1945.
[3] 1 of these plants resumed operations in December 1944.

The plant of the South Chicago Coal & Dock Co., at Chicago, Ill.—active from 1937–44, inclusive—was sold to the Chicago Briquet Co., which operated at the same address in 1945.

Of the seven plants reported under construction in 1944, two started commercial production in 1945—the Super Heat Fuel Co. at Belleville, Ill., in December and the Virginia Coal & Supply Co. at Milwaukee, Wis., in February; the two Reading Briquet Co. plants [14] at Locust Summit and St. Nicholas, Pa., postponed commercial operation until spring 1946; Elmira Coal Co. at Elmira, N. Y. and the Chemi-Coal Products Co. at King City, Calif. have not yet started production; and the plant of Western Carbon & Chemical, Inc., at Minot, N. Dak., was idle in 1945.

Two additional briquetting plants were reported under construction in 1945 to start operation in 1946—the Fort Scott Briquette Co. Inc., at Fort Scott, Kans. and the United Ice & Fuel Co. at Flint, Mich. (the latter has been making packaged fuel since 1936).

Capacity of plants.[15]—The utilization of the reported total capacity of the active briquetting plants has risen from 28 percent in 1938 to 73 percent in 1945, with little change in the number of plants. Comparative data for 1944 and 1945, given in the foregoing table, show the greatest increase in production in 1945 to be concentrated at plants with annual capacities of 200,000 tons or more.

The average output per plant has more than doubled in the past 5 years, rising from 41,000 tons in 1941 to 86,000 tons in 1945. Twenty-four plants operated every month in 1945, producing 2,416,711 tons, or 87.5 percent of the total.

The largest capacities as well as the largest productions both in 1944 and 1945 were reported by the Berwind Fuel Co. and the Stott Briquet Co., Inc., for their plants at Superior, Wis.

Capacity of plants reported under construction in 1945, with plans for operation in the near future, is estimated at 700,000 tons.

Raw fuels.—Eight kinds of raw fuels entered into the manufacture of fuel briquets in 1945, and 10 types of briquets were made from these fuels (8 alone and 2 in combination). In the following tables, the quantities of raw fuels used and tonnages of each type produced are shown wherever possible without revealing operations of individual plants.

As a direct result of the program inaugurated in 1944 by the Solid Fuels Administration for War for wider utilization of surplus anthracite fines, the use of these fines rose from 389,000 tons (at 6 plants), or 19 percent of the total raw fuels in 1943, to 927,000 (at 12 plants), or 36 percent of the total in 1945. Bituminous coal, which continued tight in 1945, dropped from 65 percent of the total raw fuels used in 1943 to 47 percent in 1945. About 25,000 tons of petroleum coke, again on the market since October 24, 1944,[16] when wartime restrictions on its use as domestic fuel were rescinded, were used by 4 operators in 1945.

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[14] Saward's Journal, Briquet Plant Starts—Reading Has One in Operation and Another Nearing Completion: Vol. 28, No. 47, Feb. 23, 1946, p. 570.

[15] For analysis of annual capacity and production of active briquetting plants in the United States 1937–44, see Minerals Yearbook, 1944, p. 1009.

[16] Coal Dealer, War Production Board Freezes Stocks of Petroleum Coke: Vol. 39, No. 7, November 1942, p. 23. War Production Board Petroleum Coke Conservation Order M-212, March 1943. Black Diamond, Chicago and Central Western Market: Vol. 113, No. 9, Oct. 28, 1944, p. 57.

Raw fuels used in making fuel briquets in the United States, 1943–45

Raw fuel	Net tons			Percent of total		
	1943	1944	1945	1943	1944	1945
Pennsylvania anthracite	388,693	711,109	926,822	18.7	30.5	35.6
Arkansas hard coals	203,357	272,242	281,185	9.8	11.7	10.8
Bituminous (high- and low-volatile) coals	1,341,013	1,188,886	1,221,254	64.6	51.0	46.9
Semicoke (lignite char)						
Residual carbon from pyrolysis of natural gas	[1] 143,381	153,025	148,991	[1] 6.9	6.5	5.7
Residual carbon from manufacture of oil gas						
Petroleum coke		6,224	24,959		.3	1.0
	2,076,444	2,331,486	2,603,211	100.0	100.0	100.0

[1] Includes a relatively small tonnage of petroleum coke of a type exempt from wartime allocation in 1943 (wartime restrictions rescinded Oct. 24, 1944).

Classification of plants and production of fuel briquets in the United States, by kinds of raw fuel used, 1943–45

Raw fuel used	1943			1944			1945		
	Plants	Briquets produced: Net tons	Briquets produced: Percent of total	Plants	Briquets produced: Net tons	Briquets produced: Percent of total	Plants	Briquets produced: Net tons	Briquets produced: Percent of total
Pennsylvania anthracite	1			2			2		
Mixture of Pennsylvania anthracite and bituminous	5	845,882	39.1	10	1,409,312	57.2	10	1,765,769	63.9
Semianthracite	4			5			4		
Mixture of Arkansas hard coals	1			1			1		
Mixture of semianthracite and bituminous	1	235,865	10.9	------	302,616	12.3	------	303,423	11.0
Mixture of semianthracite, bituminous, and petroleum coke	[1] 1			1			------		
Bituminous:									
Low-volatile	14	932,582	43.1	10	584,981	23.7	8	510,565	18.5
High-volatile	1			1			2		
Semicoke (lignite char)	1			1			1		
Residual carbon from pyrolysis of natural gas	1	149,669	6.9	1	161,910	6.6	1	156,448	5.7
Residual carbon from manufacture of oil gas	2			2			2		
Petroleum coke	------	------	------	4	6,142	.2	4	25,999	.9
	[2] 32	2,163,998	100.0	[2] 38	2,464,961	100.0	[2] 35	2,762,204	100.0

[1] Relatively small tonnage of petroleum coke of a type exempt from wartime allocation in 1943 (wartime restrictions rescinded Oct. 24, 1944).

[2] In 1943, 4 plants made 2 kinds of briquets; in 1944, 6 plants made 2 kinds and 1 plant 3 kinds; in 1945, 3 plants made 2 kinds; hence the sum of these items exceeds the total number of plants active in the respective years.

As indicated in the following table showing production with reference to supply of raw fuel, the greatest gain in output of briquets in 1945 over 1944 occurred at four plants at Lake Superior coal docks that used low-volatile bituminous coal in combination with Pennsylvania anthracite fines.

Production of fuel briquets, 1944–45, grouped according to location of plants with reference to supply of raw fuel

Location of plant	1944		1945		Change in 1945	
	Plants	Production (net tons)	Plants	Production (net tons)	Net tons	Percent
At or near Lake Superior, Lake Michigan, or Lake Huron coal docks:						
Lake Superior	4	819,674	4	1,069,868	+250,194	+30.5
Lake Michigan	7	442,950	8	453,597	+10,647	+2.4
Lake Huron	1		1			
	12	1,262,624	13	1,523,465	+260,841	+20.7
At or near coal mines:						
Eastern States	4	625,427	4	637,353	+11,926	+1.9
Central States	6	401,436	7	430,487	+29,051	+7.2
	10	1,026,863	11	1,067,840	+40,977	+4.0
At or near petroleum refineries and oil- and natural-gas plants:						
Central States	2	166,701	2	162,543	−4,158	−2.5
Pacific Coast States	3		3			
	5	166,701	5	162,543	−4,158	−2.5
At other locations:						
Eastern States	1	8,773	1	8,356	−417	−4.8
Central States	2		2			
	[1] 3	8,773	[1] 3	8,356	−417	−4.8
Total United States	30	2,464,961	32	2,762,204	+297,243	+12.1

[1] Fall River, Mass.; Jackson, Mich.; and Omaha, Nebr.

Binders.—Asphalt binders remain the preferred type in briquetting coal and coke and were used by 26 plants that produced 87 percent of the fuel briquets made in 1945. Three other plants used, respectively, asphalt and coal-tar pitch combined, asphalt and starch combined, and starch. In 1945, as in 1943 and 1944, three plants used no binder; two of these briquetted the carbon residue from the manufacture of oil gas and one used low-volatile bituminous coal.

Classification of briquetting plants in the United States, 1943–45, by percentage of binder used

Ratio of binder to raw fuel (by weight)	1943			1944			1945		
	Plants	Production		Plants	Production		Plants	Production	
		Net tons	Percent of total briquets		Net tons	Percent of total briquets		Net tons	Percent of total briquets
Less than 5 percent	4	234,747	10.8	3	58,309	2.4	4	41,333	1.5
5 and less than 7 percent	13	829,953	38.4	17	1,734,549	70.4	16	2,083,292	75.4
7 and less than 9 percent	6	983,487	45.4	4	486,366	19.7	6	475,799	17.2
9 percent or more	2			3	61,993	2.5	3	42,780	1.6
No binder	[1] 3	115,811	5.4	[1] 3	123,744	5.0	[1] 3	119,000	4.3
	28	2,163,998	100.0	30	2,464,961	100.0	32	2,762,204	100.0

[1] 2 plants use residual carbon from manufacture of oil gas, and 1 uses bituminous coal as raw fuel.

Operators reported approximately 164,000 tons of asphaltic types [17] and small quantities of starch and coal-tar pitch used as binders in 1945 in the manufacture of fuel briquets.

Seventy-five percent of the total production of fuel briquets in 1945 was made with binders ranging from 5 to 7 percent (ratio of binder to raw fuel—by weight), as compared with 31 percent of the production in 1942, 38 percent in 1943, and 70 percent in 1944.

Weight and shape.—Pillow-shaped briquets (weighing less than 5 ounces, with one exception—an 11-ounce, high-volatile bituminous pillow made by the Coal Processing Corp., at Buckner, Ill., since 1941), were made at 29 plants in 1945 and comprise approximately 70 percent of the total production. Cylindrical (barrel-shaped) briquets were made at 2 plants and 20- and 24-ounce cubes at 1 plant. Briquets weighing between 2 and 3 ounces predominate and represent 60 percent of the total production in 1945.

Prevailing weight of briquets produced in the United States, 1944–45

Weight (ounces) [1]	1944			1945		
	Plants	Production		Plants	Production	
		Net tons	Percent of total		Net tons	Percent of total
Less than 2	3	62,130	2.5	3	34,306	1.2
2 and less than 3	13	1,333,007	54.1	16	1,648,244	59.7
3 and less than 4	8	706,622	28.7	6	669,513	24.2
4 and less than 5	4	363,202	14.7	5	410,141	14.9
10 and less than 16	1			1		
16 and less than 25	2			[2] 1		
	[3] 31	2,464,961	100.0	32	2,762,204	100.0

[1] No briquets weighing between 5 and less than 10 ounces made in 1944 or 1945.
[2] This plant made cubes in 20- and 24-ounce weights.
[3] 1 plant made briquets in both 2-ounce and 3-ounce weights, and 1 made cubes in 20- and 24-ounce weights; hence the sum of these items exceeds the total number of plants.

Shipments.—Briquets are widely used in the United States; in 1945 they were shipped into 35 States and the District of Columbia and exported principally to Canada. The entire output of California, North Dakota, and Washington was consumed within those States, but the output of the other 12 producing States was also shipped to other States. States reporting the largest output in 1945 shipped their briquets as follows: From Wisconsin to 7 States and Canada; from West Virginia to 18 States, the District of Columbia, and Canada; from Pennsylvania to 16 States, the District of Columbia, and Canada; and from Missouri to 5 States.

Shipments from each producing State cannot be shown because there are only one or two producers in each of the States except Wisconsin, Missouri, and Illinois, and confidential data of individual operations would thus be revealed. However, a graphic presentation of the centers of production with corresponding States of destination for 1928 and 1936 is included in Minerals Yearbook, 1937 (p. 965, fig. 65), and since then markets have been extended still farther.

[17] Sales of briquetting asphalt as reported by the petroleum refineries to the Bureau of Mines differ slightly from the quantities reported by the briquet and packaged-fuel manufacturers as used in their processing operations.

The relatively small difference between production in 1945 (2,762,204 tons) and shipments within the United States (2,585,091) represents briquets exported, used at plants for fuel, and stocks on hand at beginning or end of 1945.

Shipments of fuel briquets of domestic manufacture in the United States, 1944–45, by States of destination, as reported by producers, in net tons [1]

State of destination	1944	1945	State of destination	1944	1945
Arkansas	614	540	New Hampshire	3,336	3,868
California	12,670	15,343	New Jersey	12,193	16,241
Connecticut	4,512	7,738	New York	48,403	66,731
Delaware	2,751	3,147	North Carolina	14,383	13,985
District of Columbia	872	1,606	North Dakota	125,331	145,401
Florida	484	615	Ohio	57,226	53,385
Georgia	139	152	Oregon	88,107	89,901
Illinois	90,358	92,143	Pennsylvania	45,104	52,247
Indiana	49,235	47,321	Rhode Island	6,281	7,100
Iowa	90,379	150,815	South Carolina	3,800	4,057
Kansas	16,595	15,384	South Dakota	118,811	139,399
Kentucky	3,477	5,149	Vermont	605	1,697
Maine	10,358	11,155	Virginia	19,082	19,687
Maryland	6,649	10,028	Washington	8,266	7,709
Massachusetts	51,075	51,153	West Virginia	2,307	1,476
Michigan	121,754	131,455	Wisconsin	448,313	535,883
Minnesota	515,671	551,855	Wyoming	----------	29
Missouri	254,360	276,471			
Montana	79	----------		2,278,480	2,585,091
Nebraska	44,900	54,225			

[1] For shipments outside the United States see table of official export statistics "Briquets exported from the United States in 1944–45, by countries of destination and customs districts."

Rail shipments generally represent consumption at distant points, and shipments by truck show local or nearby consumption.

Direct shipments of fuel briquets by rail and truck, 1944–45, as reported by producers, in net tons [1]

Produced in—	1944			1945		
	Rail	Truck [2]	Total	Rail	Truck [2]	Total
Eastern States	606,887	18,216	625,103	617,222	19,558	636,780
Central States	1,365,356	331,665	1,697,021	1,606,405	380,581	1,986,986
Pacific Coast States	20,737	88,263	109,000	24,315	88,638	112,953
Total United States	1,992,980	438,144	[3] 2,431,124	2,247,942	488,777	[3] 2,736,719

[1] Includes shipments outside the United States.
[2] Includes local deliveries.
[3] An additional 27,225 tons were used by 2 producers as fuel at their plants in 1944, and 20,139 tons in 1945

Imports and exports.—Imports of briquets into the United States for the years 1941 through 1945 were small and, except for a few tons from Mexico in 1942, all from Canada. Figures for imports since 1919, first year of record, are included in annual volumes of Mineral Resources and Minerals Yearbook.[18] Exports [19] of fuel briquets made in the United States were shipped in 1945 principally to Canada and small tonnages to Switzerland, French Morocco, France, Mexico, and Cuba.

Briquets (coal and coke) and other composition coals for fuels imported for consumption in the United States, 1941–45

Year	Net tons	Value	Year	Net tons	Value
1941	162	$791	1944	538	$3, 335
1942	334	1, 739	1945	722	4, 317
1943	198	1, 151			

Briquets (coal and coke) exported from the United States, 1944–45, by countries of destination and customs districts

	1944		1945	
	Net tons	Value	Net tons	Value
COUNTRY				
Bolivia	28	$957		
Canada	163, 607	1, 294, 180	157, 789	$1, 126, 233
Cuba			4	100
France			895	5, 200
Mexico	37	282	10	176
Morocco, French			4, 747	31, 361
Switzerland			10, 662	122, 522
	163, 672	1, 295, 419	174, 107	1, 285, 592
CUSTOMS DISTRICT				
Arizona	1	16	4	97
Buffalo	22, 818	133, 519	25, 080	149, 652
Dakota	8, 895	77, 801	29, 398	234, 003
Duluth and Superior	4, 632	37, 591	10, 062	80, 555
Florida			4, 751	31, 461
CUSTOMS DISTRICT—cont.				
Laredo	35	$254	4	$67
Maine and New Hampshire	88	502	85	495
Michigan	97, 899	837, 706	67, 727	468, 446
New York	28	957		
Philadelphia			11, 557	127, 722
Rochester	7, 461	33, 699	4, 085	20, 580
St. Lawrence	21, 691	172, 127	21, 338	172, 434
San Diego	1	12	1	12
Vermont			15	68
Washington	123	1, 235		
	163, 672	1, 295, 419	174, 107	1, 285, 592

World production.—Data compiled and published since 1913 on world production of briquets are included in annual volumes of Mineral Resources and Minerals Yearbook.[20] Such official data on production in other countries as have been obtained since the beginning of the war in 1939 are shown in the following table.

[18] 1919–29, Mineral Resources, 1929, pt. II, p. 32; 1930–35, Minerals Yearbook, 1936, p. 657; 1936, Minerals Yearbook, 1937, p. 964.
[19] Beginning of export series in 1937, Minerals Yearbook, 1938, p. 803.
[20] 1913–21, Mineral Resources, 1921, pt. II, p. 4.

World production of fuel briquets, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Algeria	(2)	(2)	(2)	49,459	45,565	50,685	85,000	(2)
Australia: Victoria [3]	420,704	421,254	(2)	440,718	420,086	421,619	435,727	(2)
Belgium	1,712,280	1,561,210	1,726,500	1,521,220	1,105,190	1,005,860	445,080	(2)
Bulgaria	85,770	88,496	100,000	(2)	(2)	(2)	(2)	(2)
Canada	(2)	(2)	(2)	(2)	(2)	(2)	277,389	(2)
Eire (Irish Free State)	20,501	(2)	5,423	15,446	21,052	90,188	123,749	(2)
France	7,475,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Germany:								
Coal [4]	6,897,245	[3] 6,950,000	[3] 6,498,000	[3] 7,855,000	[3] 7,244,000	[3] 7,185,000	[3] 6,418,000	(2)
Lignite [5]	44,007,268	[3] 44,930,000	[3] 48,853,000	[3] 54,409,000	[3] 55,293,000	[3] 59,706,000	[3] 61,549,000	(2)
Hungary	441,081	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Indochina	131,558	185,400	114,000	(2)	(2)	(2)	(2)	(2)
Italy	51,047	83,052	129,404	121,451	(2)	(2)	(2)	(2)
Netherlands:								
Coal	1,262,716	1,268,926	(2)	(2)	(2)	(2)	(2)	(2)
Lignite	60,543	68,607	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	82,123	85,079	99,315	(2)	(2)	(2)	(2)	(2)
New Zealand	29,947	29,889	28,529	20,220	13,052	12,386	12,661	(2)
Poland	222,531	(2)	(2)	(2)	(2)	(2)	(2)	59,600
Portugal	19,865	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Rumania	232,662	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain	568,000	789,815	820,479	412,453	788,612	653,994	924,862	(2)
Tunisia	86,478	83,989	48,678	24,259	20,691	(2)	(2)	(2)
Turkey	37,285	14,792	24,497	28,392	(2)	30,256	34,276	(2)
United Kingdom	507,415	813,810	(2)	(2)	(2)	749,342	883,974	(2)
United States (includes packaged fuel) [6]	936,402	1,004,902	1,211,433	1,422,866	1,815,583	2,158,728	2,395,618	2,694,639
Yugoslavia	100,945	132,466	(2)	(2)	(2)	(2)	(2)	(2)
Total	[7] 65,389,366	(2)	(2)	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed, briquets are produced in Czechoslovakia and New Caledonia, but data on output are not available.
[2] Data not available.
[3] Data for year ended March 31 of year stated.
[4] Beginning October 1939, figures include production from East Upper Silesia.
[5] Beginning October 1938, figures include production from Sudetenland.
[6] Includes packaged fuel as follows—1938: 146,012 tons; 1939: 195,504; 1940: 258,105; 1941: 244,797; 1942: 229,560; 1943: 195,592; 1944: 159,455; 1945: 188,823 tons.
[7] Total incomplete; it represents sum of figures given in table only.

PACKAGED FUEL

Packaged fuel is the trade name applied by the industry to a combination of briquetting and packaging of screenings compressed into 3- or 4-inch cubes and wrapped (six or eight in a package) in sturdy paper and sealed with gummed tape. A study of the development of the packaged-fuel industry, from its beginning with the introduction of coal blocks made from slack coal in 1928 to the peak of packaged-fuel production in 1940, was made by V. F. Parry [21] of the Bureau of Mines; this study includes operations involved in the manufacture of packaged fuel and analysis of costs in typical plants.

The phenomenal growth in popularity of packaged fuel from 1935 through 1940, its decline from 1941–44, and the beginning of its recovery in 1945 are strikingly illustrated in figure 2.

The outstanding development in the packaged-fuel industry in 1945 is successful utilization of Pennsylvania anthracite fines combined with a smaller quantity of bituminous coal in the manufacture of packaged fuel, as demonstrated by the White Glove Packaged Fuel

[21] Parry, V. F., Technical and Economic Study of Packaged Fuel: Bureau of Mines Rept. of Investigations 3757, 1944, 45 pp. (Abs. in Mining Congress Journal, November 1944, vol. 30, No. 11, pp. 24-27, under title: Packaged Fuel—A Technical and Economic Study of a Typical American Business Effort to Sell Something Better than Formerly Used.)

Division of the Blaw-Knox Co.[22] in Philadelphia, Pa., which began commercial production in June 1945. The plan to use Pennsylvania anthracite fines was sponsored by the Federal Government at the request of the Solid Fuels Administration for War [23] in 1944, and extensive experiments were made by the Bureau of Mines [24] to test the possibilities of the project.

Processes.—In 1945, 54 of the 61 packaged-fuel manufacturers used the Eberling [25] process; 2 used Glenn-Smith [26] equipment; 2 used Leemon [27] equipment; 2 used equipment designed by the Johnson Coal Cubing Co., Inc.,[28] of Detroit, Mich., and the White Glove Packaged Fuel Division of the Blaw-Knox Co. in Philadelphia, Pa., used equipment manufactured by the Blaw-Knox Co.,[29] of Pittsburgh, Pa.

Salient statistics of the packaged-fuel industry from 1941 to 1945 are summarized in the following table.

Salient statistics of the packaged-fuel industry in the United States, 1941–45

[Data regarding fuel briquets are given separately at beginning of this chapter]

Year	Production (net tons)			Value of production	Plants in operation	Average output per plant (net tons)	Average value per net ton, f. o. b. plant	
	Eastern and Pacific Coast States	Central States	Total				Eastern and Pacific Coast States	Central States
1941	9,549	260,295	269,844	$2,471,567	103	2,620	$10.95	$9.09
1942	7,583	245,465	253,048	2,540,087	89	2,843	10.74	10.02
1943	[1] 4,970	210,635	215,605	2,366,733	72	2,995	[1] 11.55	10.96
1944	[1] 3,788	171,982	175,770	2,053,343	68	2,585	[1] 12.26	11.67
1945	[1] 16,606	191,537	208,143	2,518,636	61	3,412	[1] 12.86	12.04

[1] Eastern States; no production in Pacific Coast States in 1943–45.

Production and value.—Notwithstanding the continued shortages in labor and materials and idleness at 29 packaged-fuel plants, production in 1945 increased for the first time since 1940, the peak year of production for the industry. The 61 plants active in 1945 produced 208,143 tons, with a value of $2,518,636, an increase of 18 percent in production and a 23-percent increase in value over 1944 (see fig. 2).

The upturn in production of packaged fuel is the result of resumption of operations at two plants (rebuilt after fires in 1944), production of the new plant of the White Glove Packaged Fuel Division of the Blaw-Knox Co., at Philadelphia, Pa. (starting in June 1945), and

[22] Black Diamond, Philadelphia Packaged Fuel Plant Opens: Vol. 114, No. 12, June 9, 1945, p. 17.

[23] Solid Fuels Administration for War, P. N. 71018, SFA 254, Sept. 5, 1944.

[24] Barkley, J. F., and Seymour, William, War Problem of Increasing Utilization of Small Anthracite: Mech. Eng., vol. 67, No. 7, July 1945, pp. 457–462.

Fieldner, A. C., and Brewer, R. E., Annual Report of Research and Technologic Work on Coal: Bureau of Mines Inf. Circ. 7352, 1946, pp. 68, 69, 70.

[25] Eberling, C. M., Packaged Fuel Produced by the Eberling Process: Coal Heat, vol. 28, No. 1, July 1935, pp. 64–66.

[26] Black Diamond, Briquetting Plant Solves Slack Problem: Vol. 96, No. 6, Mar. 13, 1937, p. 60. (Manufacturing and sales rights of briquetting machinery designed by Glenn Smith acquired in 1944 by Blaw-Knox Co., Pittsburgh, Pa.)

[27] Black Diamond, vol. 102, No. 12, June 17, 1939, p. 15. (Manufacture of Leemon equipment, taken over in 1940 by Besser Manufacturing Co., Alpena, Mich., has been discontinued.)

[28] Black Diamond, A Mammoth Package Fuel Plant: Vol. 102, No. 7, April 8, 1939, p. 23. Black Diamond, Packaging Coal at the Johnson Plant at Detroit: Vol. 115, No. 2, July 21, 1945, p. 20.

[29] Saward's Journal, New Packaged Fuel Plant Formally Opened in Philadelphia: Vol. 28, No. 8, May 26, 1945, p. 95. (See also footnote 26.)

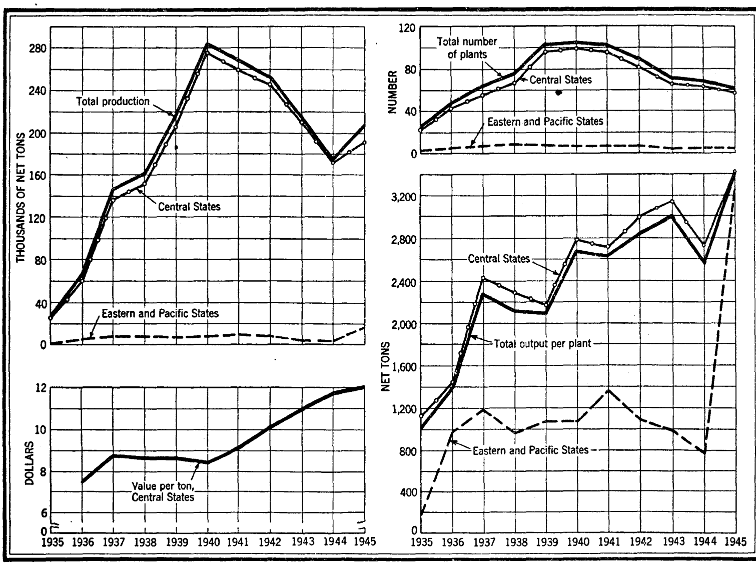

FIGURE 2.—Production of packaged fuel, output per plant, and number of plants in operation in the United States and average value per ton, f. o. b. plant (Central States), 1935–45. (NOTE.—No production in Pacific Coast States, 1943–45.)

general increases in production at plants in Michigan, Minnesota, and Ohio. Michigan regained its place in 1945 as the State with the highest output; and the largest producers were the Cleveland Cliffs Iron Co. at Green Bay, Wis., followed by the Johnson Coal Cubing Co., Inc.,[30] of Detroit, Mich. (whose plant, down for 4 months in 1944, has been rebuilt and operations resumed in November 1944).

Fires, damaging five plants in 1945 and resulting in shut-downs,

Production of packaged fuel in the United States, 1944–45, by States

[Plants and production not included in preceding fuel-briquet tables]

States	1944			1945		
	Plants	Net tons	Value	Plants	Net tons	Value
Eastern States	[1] 5	3,788	$46,450	[1] 5	16,606	$213,476
Central States:						
Illinois	4	1,837	23,037	2	(2)	(2)
Indiana	2	(2)	(2)	2	(2)	(2)
Iowa	1	(2)	(2)	1	(2)	(2)
Michigan	25	44,748	522,676	21	60,034	724,003
Minnesota	4	29,052	385,743	4	35,191	466,045
Nebraska	1	(2)	(2)	1	(2)	(2)
Ohio	16	31,423	342,399	15	32,271	376,839
Wisconsin	10	47,847	548,515	10	47,351	551,680
Undistributed [3]		17,075	184,523		16,690	186,593
Total Central States	63	171,982	2,006,893	56	191,537	2,305,160
Total United States	68	175,770	2,053,343	61	208,143	2,518,636

[1] Maine, 1; Pennsylvania, 1; and Virginia, 3.
[2] Included under "Undistributed"; Bureau of Mines not at liberty to publish figures.
[3] Includes States entered as "(2)" above.

[30] Black Diamond, Packaging Coal at the Johnson Plant at Detroit: Vol. 115, No. 2, July 21, 1945, p. 20.

point to the advisability of fireproof structures for housing equipment and care in storing raw fuels and binder materials; rebuilding these plants presents difficulties with materials, machinery, and other necessary replacements still hard to obtain.

The values, by States, represent the average per ton received by operators in 1944 and 1945 in States with three or more operators. The values do not represent the price per ton to the consumer, as many plants sell both to retailers and consumers, but rather the average per ton received by producers on the total product (exclusive of delivery charges). The value at the plant comprises cost of coal at the mine, freight rate, direct and indirect manufacturing costs, and profit.

All but three of the producing States showed increases in average realization at the plant in 1945.

Average value received per net ton of packaged fuel in the United States, 1944–45, by States

[Includes only those States where there were 3 or more plants in both years]

State	1944	1945	State	1944	1945
Michigan	$11.68	$12.06	Virginia	$11.18	$10.66
Minnesota	13.28	13.24	Wisconsin	11.46	11.65
Ohio	10.90	11.68			

Thirty-one of the 61 active plants operated each month of the year and supplied 71 percent of the total production; only 5 plants (in Michigan and Ohio) operated less than 6 months, and the output of these was small.

Monthly production of packaged fuel in the United States, 1943–45, in net tons

Month	1943	1944	1945	Month	1943	1944	1945
January	27,106	19,721	21,344	August	9,286	9,090	10,811
February	23,434	18,763	21,182	September	18,973	13,043	15,622
March	24,908	18,789	17,983	October	21,967	18,108	22,835
April	18,252	15,591	14,902	November	22,335	19,259	26,061
May	11,965	11,232	13,842	December	21,131	20,204	25,730
June	8,476	6,593	10,538				
July	7,772	5,377	7,293		215,605	175,770	208,143

Number of plants.—In 1945 the number of plants producing packaged fuel dropped further to 61. However, the record of activity among these plants is remarkable, as all but two have reported production for every year since their operations began; 44 of these plants have an unbroken record of from 6 to 11 years' activity. Twenty-two of the active plants are located in the Detroit and Cleveland areas and contribute about one-third of the national production; in addition, there were 13 idle plants in these areas in 1945.

Three plants began operating in 1945—the new large packaged-fuel plant of the White Glove Packaged Fuel Division of Blaw-Knox Co., at Philadelphia, Pa., which was under construction in 1944, began operations in June 1945; and two comparatively small plants in Monroe, Mich., and Dayton, Ohio, started operations in the fall.

Twenty-nine plants were idle in 1945 (8 of these were active in 1944, and 13 have been idle since 1943); shortages of labor and materials and inability to operate without loss under OPA price ceilings were the principal reasons given for idleness.

Two companies reported small plants under construction in 1945—one in Kansas City, Mo., and the other in Detroit, Mich. (the latter started construction in 1944).

Activity in number of packaged-fuel plants in the United States, 1940–45

Year	Active	New	Idle	Out of business	Year	Active	New	Idle	Out of business
1940	106	16	15	14	1943	72	5	23	9
1941	103	7	8	14	1944	68	4	22	7
1942	89	4	16	8	1945	61	[1] 3	[2] 29	[3] 5

[1] 1 each in Michigan, Ohio, and Pennsylvania and all active in 1945.
[2] 16 in Michigan; 3 each in Indiana, Missouri, and Ohio; 2 in Wisconsin; and 1 each in Illinois and Washington.
[3] 2 in Michigan and 1 each in Missouri, Ohio, and Pennsylvania (none of these active in 1945).

Capacity of plants.[31]—Comparative data for 1944 and 1945, given in the following table, show the greatest increase in production in 1945 to be concentrated at plants with reported capacities of 15,000 tons or more.

In 1945, 51 plants produced less than 5,000 tons each, contributing 74,719 tons (or 36 percent of the total production), utilizing 40 percent of the capacity of this group; the other 10 active plants, each producing more than 5,000 tons, contributed 133,424 tons (or 64 percent of the total production), utilizing 50 percent of their combined capacity.

The output per plant attained its highest average in 1945, rising from 2,585 tons in 1944 to 3,412 tons in 1945.

The largest annual capacities in 1945 were reported for the plants of the White Glove Packaged Fuel Division of the Blaw-Knox Co., at Philadelphia, Pa., and the Johnson Coal Co., Inc., at Detroit, Mich.

Raw fuels.—Five kinds of raw fuels entered into the manufacture of packaged fuel in 1945. The plant of the White Glove Packaged Fuel Division of the Blaw-Knox Co., in Philadelphia, Pa.[32] (using Pennsylvania anthracite fines combined with a smaller quantity of bituminous low-volatile), began operations in June 1945, but production in 1945 was not as large as anticipated. About 16,000 tons of petroleum coke—again on the market since October 24, 1944[33]—was used at eight plants in 1945.

One large operator (who makes both packaged fuel and fuel briquets and who uses only shipped-in bituminous low-volatile) reports his processing operations severely handicapped due to the wetness or frozen condition of the coal as received:

[31] For analysis of annual capacity and production of active packaged-fuel plants in the United States, 1937–44, see Minerals Yearbook, 1944, p. 1019.
[32] Black Diamond, Philadelphia Packaged Fuel Plant Opens: Vol. 114, No. 12, June 9, 1945, p. 17.
[33] Coal Dealer, War Production Board Freezes Stocks of Petroleum Coke: Vol. 39, No. 7, November 1942, p. 23. War Production Board Petroleum Coke Conservation Order M–212, March 1943. Black Diamond, Chicago and Central Western Market: Vol. 113, No. 9, Oct. 28, 1944, p. 57.

Annual capacity and production of active packaged-fuel plants in the United States, 1944–45

	1944					1945				
	Active plants		Production			Active plants		Production		
				Percent of—					Percent of—	
	Number	Annual capacity (net tons)	Net tons	Annual capacity	Annual production	Number	Annual capacity (net tons)	Net tons	Annual capacity	Annual production
Capacity of—										
Less than 5,000 tons	[1] 45	120, 200	48, 040	40. 0	27. 3	[1] 37	103, 920	39, 984	38. 5	19. 2
5,000 and less than 10,000	12	66, 900	27, 943	41. 8	15. 9	14	82, 900	36, 312	43. 8	17. 4
10,000 and less than 15,000	6	67, 000	31, 016	46. 3	17. 7	3	33, 000	22, 594	68. 5	10. 9
15,000 and less than 25,000	3					3	60, 000	44, 364	73. 9	21. 3
25,000 and less than 40,000	1	174, 500	68, 771	39. 4	39. 1	3	172, 500	64, 889	37. 6	31. 2
40,000 and less than 60,000	-----					-----				
60,000 tons or more	1					1				
	68	428, 600	175, 770	41. 0	100. 0	61	452, 320	208, 143	46. 0	100. 0
Production of—										
Less than 500 tons	[1] 18	41, 000	4, 434	10. 8	2. 5	[1] 15	42, 020	3, 737	8. 9	1. 8
500 and less than 1,000	7	21, 700	4, 221	19. 5	2. 4	7	17, 200	4, 318	25. 1	2. 1
1,000 and less than 3,000	28	109, 300	50, 780	46. 5	28. 9	22	86, 000	41, 191	47. 9	19. 8
3,000 and less than 5,000	8	59, 100	31, 760	53. 7	18. 1	7	42, 600	25, 473	59. 8	12. 2
5,000 and less than 10,000	3	105, 500	22, 480	21. 3	12. 8	4	57, 000	31, 742	55. 7	15. 3
10,000 and less than 25,000	3	92, 000	62, 095	67. 5	35. 3	5	207, 500	101, 682	49. 0	48. 8
25,000 tons or more	1					1				
	68	428, 600	175, 770	41. 0	100. 0	61	452, 320	208, 143	46. 0	100. 0

[1] 2 of these operated only a few months late in year.

Raw fuels used in making packaged fuel in the United States, 1943–45

Raw fuel	1943		1944		1945	
	Plants	Net tons	Plants	Net tons	Plants	Net tons
Bituminous:						
Low-volatile	69	206, 059	65	156, 388	59	174, 164
High-volatile	2		3	316	3	3, 123
Pennsylvania anthracite	-----	-----	1	4, 597	1	11, 168
Semianthracite	2	6, 613	2		2	
Coke breeze	-----		1		-----	-----
Petroleum coke	[1] 2		7	12, 560	8	15, 995
	[2] 75	212, 672	[2] 79	173, 861	[2] 73	204, 450

[1] These plants reported a relatively small tonnage of petroleum coke of a type exempt from wartime allocation in 1943 (wartime restrictions rescinded Oct. 24, 1944).

[2] In 1943, 69 plants used 1 kind of fuel only, 1 used 2 kinds (separately), and 2 used mixtures of 2 kinds; in 1944, 57 plants used 1 kind of fuel only, 7 used 2 kinds (separately), and 4 used mixtures of 2 kinds; and in 1945, 50 plants used 1 kind of fuel only, 8 used 2 kinds (separately), 1 used 3 kinds (separately), and 2 used mixtures of 2 kinds. Hence the number of items exceeds the total number of active plants in the respective years.

Six types of packaged fuel, with bituminous low-volatile cubes and petroleum-coke cubes predominating, were made in 1945, as follows:

Classification of plants and production of packaged fuel in the United States in 1944–45, by kinds of raw fuel used

Raw fuel used	1944			1945		
	Plants	Packaged fuel produced		Plants	Packaged fuel produced	
		Net tons	Percent of total		Net tons	Percent of total
Bituminous:						
Low-volatile (exclusively)	61	151,626	86.3	57	167,309	80.4
High-volatile (exclusively)	2			3	3,147	1.5
Mixture of bituminous low- and high-volatile	1	12,265	7.0	---------	23,154	11.1
Mixture of bituminous low-volatile and Pennsylvania anthracite	1			1		
Mixture of bituminous low-volatile and petroleum coke	1			1		
Mixture of bituminous low-volatile and coke breeze	1			---------		
Semianthracite (exclusively)	2			2		
Petroleum coke (exclusively)	6	11,879	6.7	7	14,533	7.0
	[1] 75	175,770	100.0	[1] 71	208,143	100.0

[1] In 1944, 2 types of packaged fuel were made at 7 plants; in 1945, 3 types were made at 1 plant and 2 types at 8 plants; hence the sum of these items exceeds the total number of plants active in the respective years.

In 1945, about 158,000 tons (77 percent of the total raw fuels) were shipped-in slack from the mines and from the Lake docks. The remainder represents yard screenings. Fourteen of the 61 operators used shipped-in slack exclusively, 20 used yard screenings exclusively, and 27 used both shipped-in slack and yard screenings.

Cubes measuring 3 to 3¾ inches were made at 50 plants, and 4-inch cubes were made at 16 plants; 5 plants made cubes in two sizes.

Twenty-two plants reported wrapping the cubes by machine, 12 by hand, and 27 by a combination of machine and hand. Fifty-five plants wrapped 6 cubes to a package, 5 plants 8 to a package, and only 1 reported a package of 4 cubes.

Forty-seven plants made packages weighing 9 to 11 pounds, 18 made packages of 11 to 16 pounds, and 1 (the White Glove plant at Philadelphia) reported making packages of six 3-inch cubes weighing approximately 7 pounds; 5 plants made packages of two weights, from 10 to 15 pounds.

Only one plant reported sales of packaged fuel in bulk (unwrapped), amounting to less than 200 tons; these were made of bituminous low-volatile and asphalt binder.

Binders.—Cornstarches totaling 1,094 tons were used as binder by 59 plants, which produced 151,338 tons of packaged fuel, or 73 percent of the total production in 1945. Thirty-one plants reported using 15 pounds of starch per ton, 19 used over 15 pounds, and 9 less than 15. Asphalt[34] totaling 2,600 tons was used alone as binder by 3 plants, and 1 plant making petroleum-coke cubes used a combination of starch and asphalt. No cement was reported in 1944 or 1945.

[34] See footnote 17.

Classification of packaged-fuel plants in the United States, 1944–45, by type and percentage of binder used

Type of binder	Plants		Ratio of binder to raw fuel (by weight)	Plants	
	1944	1945		1944	1945
Starch	66	58	Less than 0.5 percent	-------	-------
Starch and asphalt	1	1	0.5 and less than 1 percent	56	52
Asphalt	2	3	1 and less than 2 percent	11	6
			2 and less than 3 percent	-------	-------
			3 and less than 5 percent	-------	1
			5 percent or more	2	2
	[1] 69	[1] 62		[1] 69	61

[1] In 1944 and 1945, 1 plant making 2 types of packaged fuel used starch binder for one and starch and asphal for the other; hence the sum of these items exceeds the number of active plants.

Shipments.—Local sales (called for by passenger car or delivered by truck) amounted to 171,621 tons and accounted for 83 percent of the 1945 total sales; other than local (shipped by truck to points in Wisconsin, Minnesota, and Michigan), 11 percent; and shipments by rail (to points in Wisconsin, Michigan, Minnesota, and Iowa), about 6 percent.

Shipments of packaged fuel in the United States by method of movement, 1943–45, in net tons

Year	Shipped by truck			Shipped by rail	Total
	Local sales [1]	Other than local sales	Total truck		
1943	167,800	33,582	201,382	14,137	215,519
1944	139,026	24,302	163,328	12,389	175,717
1945	171,621	23,381	195,002	11,713	206,715

[1] Includes sales called for and delivered.

PEAT

By J. A. Corgan and Golden V. Chiriaco

SUMMARY OUTLINE

SUMMARY

According to reports received by the Bureau of Mines, peat production in the United States in 1945 totaled 78,272 short tons with a value of $600,287 and was 73 percent of the peak United States production of 107,261 tons in 1918. In 1944 the output was 57,987 tons valued at $524,521.

Shortage of labor and equipment, a major problem in the peat industry for the past several years, continued through 1945; however, some operators expressed hope of a more favorable outlook for 1946.

Imports of peat moss, cut drastically in 1940 because of the war, have been increasing steadily since then, the quantity imported in 1945 totaling 77,673 short tons, valued at $2,393,214. These figures compare favorably with the prewar figure of 78,611 tons, valued at $1,204,883, imported in 1939. In 1944, 64,428 tons, valued at $1,916,794, were imported. As no exports are reported, the quantity of peat available for domestic consumption in 1945 amounted to 155,945 tons, an increase over the 122,415 tons available in 1944. Approximately 88 percent of the peat sales in 1945 was used for soil improvement and in mixed fertilizers.

Reserves.—Peat, an integral part of the natural resources of the country, is found in about half of the States. An estimate of 13,827,000,000 tons has been calculated as air-dried peat.[1]

Minnesota, Wisconsin, and Michigan combined contain 75 percent of the reserves; 14 percent of the country's total is in Florida, and the rest is distributed through the New England and Pacific Coast States.

PRODUCTION

Of the 104 operators reporting to the Bureau of Mines for 1945, only 44 operating in 19 States contributed to the total 1945 production of 78,272 short tons, whereas the 1944 production of 57,987 tons represents the total output of 35 producers operating in 17 States.

[1] Soper, E. K., and Osbon, C. C., The Occurrence and Uses of Peat in the United States: Geol. Survey Bull. 728, 1922, p. 92.

The increase in production in 1945 over 1944 can be attributed to a more extensive canvass made possible by the cooperation of the county agricultural agents, United States Department of Agriculture, in certain States, who, at the request of the Bureau of Mines, supplied the names and addresses of all peat producers in their respective counties. Considered on the basis of the 1944 canvass, peat production dropped slightly in 1945, as 5 plants were closed in addition to the 16 reported closed in 1944, none of which had resumed operations at the end of 1945. Of the 26 operators who produced peat both in 1944 and 1945, 13 showed a higher output for 1945; the others, with the exception of 1, produced less. Virtually all operators producing low or no tonnage cited their inability to procure sufficient labor and equipment as the chief reason.

The average value per ton in 1945 was $7.67, a decrease of 15 percent from the 1944 value of $9.05. Production and value for 1940–45 are shown in the following table.

Peat produced in the United States, 1940–45

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average per ton			Total	Average per ton
1940	70,097	$516,865	$7.37	1943	60,002	$491,460	$8.19
1941	86,503	657,556	7.60	1944	57,987	524,521	9.05
1942	71,500	516,887	7.23	1945 [1]	78,272	600,287	7.67

[1] Wider coverage. See explanation under "Production."

The trend in production and value of peat from 1908 to 1926 and from 1934 to 1945 is pictured graphically in figure 1. Data for 1927 to 1933, inclusive, are not available, as the Federal Government made no canvass of the peat industry for those years.

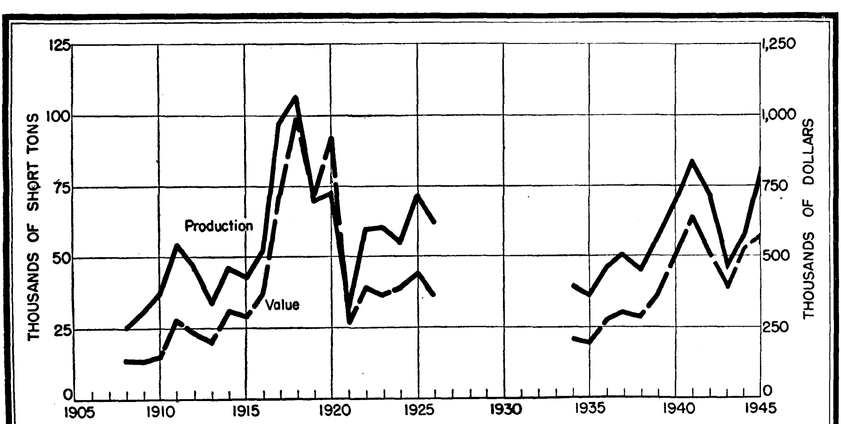

FIGURE 1.—Quantity and value of peat production in the United States, 1908–26 and 1934–45; no data available for 1927–33.

Florida ranked highest in peat production in 1945, followed in order of output by New Jersey, Illinois, Michigan, California, New York, Minnesota, Pennsylvania, Connecticut, Washington, Iowa, Wisconsin, Georgia, Ohio, Maine, Texas, Colorado, Massachusetts, and New Hampshire. In 1944 New Jersey was the highest producing State, with Illinois, Michigan, and Pennsylvania next in order, the position of the other States, except California and New Hampshire, varying also from that of 1945.

In 1945, for the first time since producers were asked to state the kinds of peat produced, peat humus failed to comprise the largest part of the production. Reed or sedge peat, produced in 11 States, comprised about 53 percent of the total production; peat humus, produced in 13 States, 33 percent; and moss peat and other, produced in 7 States, 14 percent.

USES

For many years reports have indicated that the most prevalent use of peat in this country is for soil improvement. Of the sales reported in 1945, 64 percent was sold for soil improvement; 24 percent for use in mixed fertilizers; and 12 percent for other uses, including fuel for the first time in recent years, litter for barns and poultry yards, and as a packing for bulbs, fruits, vegetables, and fragile articles. Although peat is used extensively in some European countries as fuel, it has not been used for fuel purposes in this country on a commercial scale because of plentiful supplies of higher-grade fuels. The quantity reported sold for this purpose in 1945 is negligible.

United States Government specifications.—The Federal Government purchases a certain amount of peat, provided the peat meets required specifications. These specifications may be obtained from the Procurement Division, United States Treasury Department, Washington 25, D. C.

IMPORTS [2]

Imports in 1945, all from Canada, totaled 77,673 short tons, valued at $2,393,214. Before 1939 most of the peat imported came from Germany. In 1938 Germany supplied 36,381 tons, valued at $525,564; in the same year, the Netherlands and Sweden together supplied 21,836 tons, valued at $348,252. The opportunity for increasing output, presented to producers in the United States by the decline in imports from other countries, has been thwarted to a great extent because of difficulties in obtaining necessary labor and materials.

The average value per short ton of imported peat was $30.81 in 1945 compared with $29.75 in 1944.

Peat moss imported for consumption in the United States, 1940–45

Year	Short tons	Value	Year	Short tons	Value
1940	21,689	$454,632	1943	59,427	$1,577,388
1941	30,342	704,264	1944	64,428	1,916,794
1942	49,236	1,219,473	1945	77,673	2,393,214

[2] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Peat moss imported for consumption in the United States, 1943–45, by grades

[All from Canada]

Year	Poultry and stable grade		Fertilizer grade		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1943	32,070	$910,898	27,357	$666,490	59,427	$1,577,388
1944	37,035	1,162,287	27,393	754,507	64,428	1,916,794
1945	44,289	1,465,531	33,384	927,683	77,673	2,393,214

WORLD PRODUCTION

Because of economic chaos brought about by the war, it has been difficult to obtain data on production of peat in foreign countries. The latest available data are given in the following table.

World production of peat, 1939–45, by countries [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943	1944	1945
Canada:							
Fuel ---- metric tons	404	27	322	156	709	584	113
Peat moss ---- do	(2)	15,591	25,222	48,540	58,386	72,979	76,066
Denmark ---- do	(2)	[3]2,500,000	[3]2,500,000	[3]4,600,000	[3]6,000,000	[3]5,640,000	(2)
Eire [4] ---- do	[5]3,392,591	[5]3,624,250	5,398,274	4,312,738	4,954,895	5,302,477	(2)
Finland ---- do	(2)	[3]30,000	[3]100,000	[3]130,000	[3]200,000	(2)	(2)
Iceland ---- do	(2)	24,344	18,003	(2)	11,560	11,973	11,000
Italy ---- do	5,220	9,433	19,510	134,463	[6]59,204	(2)	(2)
Latvia:							
Litter ---- cubic meters	80,000	(2)	(2)	(2)	(2)	(2)	(2)
Waste ---- do	20,000	(2)	(2)	(2)	(2)	(2)	(2)
Insulation ---- do	3,000	(2)	(2)	(2)	(2)	(2)	(2)
Lithuania ---- metric tons	230,000	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands ---- do	822,400	842,000	(2)	(2)	(2)	(2)	(2)
Norway ---- do	(2)	(2)	127,000	185,000	(2)	(2)	(2)
Sweden:							
Fuel ---- do	22,953	76,367	234,934	[3]700,000	[3]1,200,000	(2)	(2)
Litter, baled ---- do	101,883	123,201	118,599	(2)	(2)	(2)	(2)
Litter and "mull," unbaled cubic meters	35,724	6,000	3,649	(2)	(2)	(2)	(2)
"Mull," baled ---- metric tons	29,220	25,543	26,420	(2)	(2)	(2)	(2)
Switzerland ---- do	15,000	12,000	[3]40,000	[3]200,000	[3]430,000	[3]310,000	497,429
U. S. S. R. ---- do	(2)	[3]31,800,000	(2)	(2)	(2)	(2)	[3]19,760,000
United States ---- do	50,333	63,591	78,474	64,863	54,433	52,605	71,007

[1] In addition to countries listed, Argentina, Austria, Estonia, France, Germany, Hungary, and Poland produce peat, but data of production are not available.
[2] Data not available.
[3] Estimate.
[4] Figures rendered for 1942 and earlier years relate to production by holders of agricultural land only; those for later years cover total production.
[5] Fiscal year ended Apr. 30 of year stated.
[6] January to June, inclusive.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS[1]

By A. G. White, F. S. Lott, J. C. Casper, A. T. Coumbe, and A. L. Clapp

SUMMARY OUTLINE

GENERAL REVIEW

In 1945 the production of crude petroleum in the United States and the total demand for oil products exceeded all previous records. The production of crude petroleum amounted to 1,711 million barrels—a gain of 33 million barrels or about 2 percent compared with 1944. This production was 22 percent above the prewar peak of 1,402 million barrels in 1941. The total demand for all oils rose from 1,879 million barrels in 1944 to 1,952 million in 1945—a gain of 4 percent. Total exports declined from 208 million barrels in 1944 to 184 million in 1942, but domestic demand rose from 1,671 million barrels to 1,768 million.

The gain in the total demand for all oils in 1945 amounted to 73 million barrels, representing an increase of 52 million barrels in total motor-fuel demand and gains of almost 11 million barrels in residual fuel-oil demand, of 7 million barrels in distillate fuel-oil demand, of 5 million barrels in kerosine demand, and of about 1 million barrels in the demand for lubricating oils.

The total demand for motor fuel rose from 733 million barrels in 1944 to 785 million in 1945. Exports decreased from 100 million to 89 million, while domestic demand, including total deliveries from continental United States for our own military use at home and abroad, rose from 633 million barrels to 696 million. The decline in exports occurred primarily after the termination of lend-lease shipments in August, and the greatest increase in domestic demand resulted from the large military requirements in the first half of the year and the

[1] Data for 1945 are preliminary: detailed statistics with final revisions will be released later.

expansion in civilian consumption in the latter half of the year with termination of gasoline rationing in August.

The total demand for residual fuel oil rose from over 524 million barrels in 1944 to 535 million in 1945. Domestic demand increased about 11 million barrels, and there was a small decline in exports. Military, shipping, and railroad consumption remained at a high level during the year. The total demand for distillate fuel oil amounted to 253 million barrels in 1944 and 260 million in 1945. Exports declined almost 10 million barrels in 1945 and domestic demand increased about 17 million barrels. The greatest gain was in civilian consumption with termination of rationing.

Total demand for all oils in the United States, 1936–45

[Millions of barrels]

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
1936	1,092.7	132.0	1,224.7	1941	1,485.8	108.8	1,594.6
1937	1,169.7	172.8	1,342.5	1942	1,449.9	116.9	1,566.8
1938	1,137.1	193.7	1,330.8	1943	1,521.4	150.0	1,671.4
1939	1,231.1	188.9	1,420.0	1944	1,671.3	207.6	1,878.9
1940	1,326.6	130.5	1,457.1	1945 [1]	1,767.8	184.3	1,952.1

[1] Subject to revision.

The total demand for all oils in 1945 was 22 percent greater than in 1941, with gains of 13 percent in total motor-fuel demand, 35 percent in residual fuel-oil demand, 37 percent in distillate fuel-oil demand, 13 percent in kerosine demand, and 21 percent in the total demand for all other oils.

The principal changes in the supply of all oils in 1945, compared with 1944, included a gain of 33.2 million barrels in crude-oil production, an increase of 11.2 million barrels in the output of natural gasoline and cycle plants, a rise of 21.1 million barrels in total imports, and a reduction of 13.1 million barrels in total stocks. The production of crude petroleum averaged 4,584,000 barrels daily in 1944 and 4,688,000 barrels daily in 1945. Imports of crude petroleum increased from 44.8 million barrels in 1944 to 74.1 million in 1945, while imports of refined oils declined from 47.5 million barrels in 1944 to 39.3 million in 1945. Total crude stocks were reduced by 3.5 million barrels, and stocks of refined oils decreased 9.9 million barrels. Comparing 1945 with 1941, the production of all oils showed a gain of 23 percent, and imports were 17 percent larger.

In view of the fact that 1945 represented a transition from the peak of war demand in the first half of the year to unrestricted civilian consumption in the latter half, a brief review of operations, by quarters, will assist in understanding the trends of supply and demand.

In the first quarter of 1945 the total demand for all oils averaged 5,575,000 barrels daily, compared with 5,361,000 barrels daily in the fourth quarter of 1944. Exports amounted to 542,000 barrels daily, and the domestic demand—5,033,000 barrels daily—was at the highest recorded level of the war period. Crude production averaged 4,769,000 barrels daily and total crude runs to stills 4,736,000 barrels daily. Imports rose to 271,000 barrels daily, and a new supply was supplemented by a withdrawal of 102,000 barrels daily from stocks.

Salient statistics of crude petroleum, refined products, and natural gasoline in the United States, 1941–45

	1941	1942	1943	1944	1945 [1]
Crude petroleum:					
Domestic production.....thousands of barrels [2]..	1,402,228	1,386,645	1,505,613	1,677,904	1,711,103
World production.........do....	2,222,941	2,079,866	2,231,423	2,614,345	2,624,929
United States proportion of world production percent..	63	67	67	64	65
Imports [3].........thousands of barrels [2]..	50,606	12,297	13,833	44,805	74,095
Exports [3].........do....	33,238	33,834	41,342	34,238	32,998
Stocks, end of period:					
Gasoline-bearing crude.........do....	247,499	234,889	243,506 [5] 242,132	220,862 [5] 220,663	218,763
California heavy crude.........do....	10,179	10,865	8,289 [5] 7,272	6,107	4,496
Runs to stills.........do....	1,409,192	1,334,103	1,429,738	1,665,684	1,719,534
Total value of domestic production at wells thousands of dollars..	1,602,000	1,643,470	1,809,020	2,032,960	[6] 2,093,300
Average price per barrel at wells.........	$1.14	$1.19	$1.20	$1.21	$1.22
Total producing oil wells in the United States, Dec. 31.........	399,960	404,840	407,170	412,220	(7)
Total oil wells completed in the United States during year.........	19,195	10,524	9,717	13,029	14,297
Refined products:					
Imports [4].........thousands of barrels [2]..	46,536	23,669	49,579	47,506	39,278
Exports [4].........do....	75,592	83,073	108,615	173,378	151,275
Stocks, end of period.........do....	290,375 [5] 294,310	247,554	229,362	245,868	235,998
Output of motor fuel.........do....	701,294	608,900	608,180	739,340	799,059
Yield of gasoline.........percent..	44.2	39.8	37.1	39.4	40.9
Completed refineries, end of year.........	522	471	452	(7)	(7)
Daily crude oil capacity of refineries thousands of barrels [2]..	4,957	4,902	5,093	(7)	(7)
Average dealers' net price (excluding tax) of gasoline in 50 United States cities..cents per gallon [8].	9.49	10.44	10.45	10.49	10.33
Natural gasoline:					
Production.........thousands of barrels [2]..	80,855	83,322	87,716	100,046	111,274
Stocks, end of period.........do....	4,275 [5] 4,437	4,632	4,541	4,252 [5] 4,451	4,322

[1] Subject to revision.
[2] 42 gallons to the barrel.
[3] As reported to Bureau of Mines.
[4] U. S. Department of Commerce; exports include shipments to noncontiguous Territories.
[5] For comparison with succeeding year.
[6] Estimated.
[7] Figures not available.
[8] American Petroleum Institute.

In the second quarter of 1945 total demand averaged 5,576,000 barrels daily—a minor increase compared with the first quarter and a new record in total quarterly demand. Crude production of 4,842,000 barrels daily and crude runs of 4,892,000 daily represented the highest quarterly levels attained during the war. Exports of 699,000 barrels daily were the highest for the year but domestic demand declined to 4,877,000 barrels daily. Imports rose to 324,000 barrels daily, and a new supply was supplemented by withdrawal of 218,000 barrels daily from stocks.

The first and second quarters represented the highest levels of supply and demand attained during the war. With the decline in new military purchases and the termination of lend-lease shipments in August, production and total demand declined in the last two quarters of 1945.

In the third quarter of 1945 total demand declined sharply to 5,207,000 barrels daily. Exports were reduced to 422,000 barrels daily and domestic demand to 4,785,000 barrels daily. Crude production declined to 4,728,000 barrels daily, imports were reduced to 291,000 barrels daily, and 116,000 barrels daily were added to stocks

Supply and demand of all oils in the United States in 1944–45, by months

[Including wax, coke, asphalt, and still gas in thousands of barrels]

	1944 [1]													1943 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	135,682	128,842	136,814	133,588	141,189	137,263	141,438	145,407	142,985	146,911	142,463	145,322	1,677,904	1,505,613
Natural gasoline	7,821	7,565	8,050	7,828	8,277	8,187	8,567	8,592	8,448	8,890	8,824	8,997	100,046	87,716
Benzol	200	200	200	200	200	200	200	200	200	200	200	200	2,400	2,400
Total production	143,703	136,607	145,064	141,616	149,666	145,650	150,205	154,199	151,633	156,001	151,487	154,519	1,780,350	1,595,729
Imports:														
Crude petroleum [2]	3,083	3,183	2,281	3,371	4,217	3,719	3,195	4,975	3,802	5,575	3,377	4,027	44,805	13,833
Refined products [3]	3,978	3,477	4,253	4,934	5,963	4,276	4,390	3,569	3,881	2,596	2,973	3,216	47,506	49,579
Total new supply, all oils	150,764	143,267	151,598	149,921	159,846	153,645	157,790	162,743	159,316	164,172	157,837	161,762	1,872,661	1,659,141
Change in stocks, all oils	−3,790	−1,506	−5,649	−304	+3,334	−2,399	+1,858	+4,942	+6,699	+3,479	−2,832	−10,050	−6,218	−12,242
Demand:														
Total demand	154,554	144,773	157,247	150,225	156,512	156,044	155,932	157,801	152,617	160,693	160,669	171,812	1,878,879	1,671,383
Exports:														
Crude petroleum [2]	2,488	1,904	2,105	2,891	3,136	3,642	3,516	3,387	3,354	2,990	3,001	1,824	34,238	41,342
Refined products [3]	8,596	10,134	10,170	13,546	16,831	20,592	18,194	19,535	14,955	16,804	12,263	11,758	173,378	108,615
Domestic demand:														
Motor fuel	47,540	46,754	52,263	50,005	54,230	54,266	55,119	55,616	56,318	53,154	54,967	52,250	632,482	568,238
Kerosine	7,987	7,255	7,480	5,912	5,030	4,139	3,574	3,874	4,694	6,307	6,750	8,810	71,812	68,598
Distillate fuel oil	24,145	20,156	22,270	16,056	15,918	12,436	13,507	13,105	12,730	14,837	18,894	25,266	209,320	208,110
Residual fuel oil	45,601	41,852	43,645	44,094	42,108	39,622	39,127	38,813	38,279	43,969	44,481	50,429	512,020	467,008
Lubricating oil	2,576	2,570	2,692	2,570	2,631	2,754	2,625	2,734	2,556	2,941	3,032	2,682	32,363	31,459
Miscellaneous	15,621	14,148	16,622	15,151	16,628	18,593	20,270	20,737	19,731	19,691	17,281	18,793	213,266	178,013
Total domestic demand	143,470	132,735	144,972	133,788	136,545	131,810	134,222	134,879	134,308	140,899	145,405	158,230	1,671,263	1,521,426
Stocks:														
Gasoline-bearing crude in U. S.	241,245	241,718	236,220	234,694	235,176	229,631	223,503	223,901	222,868	223,500	222,759	220,862	220,862	242,132
Heavy crude petroleum in California	6,852	6,553	6,766	6,473	6,254	6,118	6,186	6,291	6,469	6,487	6,482	6,107	6,107	7,272
Natural gasoline	4,296	4,245	4,242	4,213	4,436	4,477	4,425	4,211	4,141	4,160	4,334	4,252	[4] 4,252	4,541
Refined products	227,124	225,495	225,134	226,678	229,526	232,767	240,737	245,390	253,014	255,824	253,564	245,868	245,868	229,362
Total, all oils	479,517	478,011	472,362	472,058	475,392	472,993	474,851	479,793	486,492	489,971	487,139	477,089	477,089	483,307

See footnote at end of table

Supply and demand of all oils in the United States in 1944–45, by months—Continued

[Including wax, coke, asphalt, and still gas in thousands of barrels]

	1945 [5]													1944 (total)
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
New supply:														
Domestic production:														
Crude petroleum	147,186	133,238	148,758	144,025	150,985	145,610	151,606	150,965	132,386	132,597	135,252	138,495	1,711,103	1,677,904
Natural gasoline	9,603	8,753	9,523	9,258	9,707	9,281	9,517	9,411	8,329	9,027	9,234	9,631	111,274	100,046
Benzol	240	240	240	240	240	240	240	240	240	240	240	240	2,880	2,400
Total production	157,029	142,231	158,521	153,523	160,932	155,131	161,363	160,616	140,955	141,864	144,726	148,366	1,825,257	1,780,350
Imports:														
Crude petroleum [2]	3,969	3,939	6,197	5,151	6,621	5,620	7,601	7,230	5,517	7,347	7,395	7,508	74,095	44,805
Refined products [3]	2,966	2,669	4,621	4,220	3,843	4,055	2,392	2,409	1,674	2,941	4,359	3,129	39,278	47,506
Total new supply, all oils	163,964	148,839	169,339	162,894	171,396	164,806	171,356	170,255	148,146	152,152	156,480	159,003	1,938,630	1,872,661
Change in stocks, all oils	−10,541	−7,481	−1,578	−2,619	−3,219	−2,477	+3,985	+7,182	−457	+2,989	+4,255	−3,549	−13,510	−6,218
Demand:														
Total demand	174,505	156,320	170,917	165,513	174,615	167,283	167,371	163,073	148,603	149,163	152,225	162,552	1,952,140	1,878,879
Exports:														
Crude petroleum [2]	1,302	1,599	1,973	2,663	3,208	2,915	3,533	3,308	3,166	3,603	3,399	2,329	32,998	34,238
Refined products [3]	15,124	10,953	17,783	18,248	18,983	17,567	13,080	7,506	8,254	7,070	7,736	8,971	151,275	173,378
Domestic demand:														
Motor fuel	51,125	49,013	55,449	59,147	60,828	60,597	66,218	70,027	64,550	55,743	53,581	50,129	696,407	632,482
Kerosene	8,831	7,600	6,780	4,521	5,459	4,741	4,402	3,789	5,254	6,775	7,613	9,830	75,595	71,812
Distillate fuel oil	25,025	23,456	19,800	15,654	18,267	14,719	15,353	14,998	14,207	16,546	19,102	28,626	225,753	209,320
Residual fuel oil	51,976	44,942	47,961	43,680	45,053	43,151	41,434	40,350	35,469	40,627	42,713	45,726	523,082	512,020
Lubricating oil	3,094	2,787	3,247	3,265	3,370	3,132	3,261	3,120	2,327	2,577	2,532	2,606	35,318	32,363
Miscellaneous	18,028	15,970	17,924	18,335	19,447	20,461	20,090	19,975	15,376	16,222	15.549	14,335	211,712	213,266
Total domestic demand	158,079	143,768	151,161	144,602	152,424	146,801	150,758	152,259	137,183	138,490	141,090	151,252	1,767,867	1,671,263
Stocks:														
Gasoline-bearing crude in United States	221,737	220,221	223,988	224,229	223,151	218,218	216,638	215,135	220,319	221,246	218,916	218,763	218,763	[6] 220,663
Heavy crude petroleum in California	6,026	5,791	5,567	5,415	5,063	5,044	4,793	4,821	4,437	4,606	4,610	4,496	4,496	6,107
Natural gasoline	4,160	4,618	4,644	4,783	4,873	4,723	4,338	4,048	3,985	3,959	4,325	4,322	4,322	[6] 4,451
Refined products	234,625	228,437	223,290	220,443	218,564	221,189	227,390	236,337	231,143	233,062	239,277	235,998	235,998	245,868
Total, all oils	466,548	459,067	457,489	454,870	451,651	449,174	453,159	460,341	459,884	462,873	467,128	463,579	463,579	477,089

[1] Final figures.
[2] As reported to Bureau of Mines.
[3] U. S. Department of Commerce.
[4] For comparison with 1943.
[5] Subject to revision.
[6] For comparison with 1945.

during the quarter. Crude runs to stills dropped to 4,740,000 barrels daily, and the average was decreased further by refinery shut-downs in the latter part of September due to strikes.

In the fourth quarter of 1945 total demand declined further to 5,042,000 barrels daily. Exports dropped to 360,000 barrels daily and domestic demand to 4,683,000 barrels daily. Crude production reached the lowest level of the year at 4,417,000, and crude runs declined to 4,479,000 barrels daily—affected, in part, by the continuation of refinery shut-downs in the first half of October. Imports, however, rose to 355,000 barrels daily. Even though supply was reduced, about 40,000 barrels daily were added to total stocks. The major stock increment was in gasoline, and stocks of fuel oils and kerosine were at very low levels by the end of the year.

In the first quarter of 1946 total demand for all oils amounted to 5,255,000 barrels daily—a decline of 320,000 barrels daily compared with the first quarter of 1945 but 212,000 barrels daily greater than in the last quarter of 1945. Exports rose to 405,000 barrels daily, and domestic demand increased to 4,850,000 barrels daily, with motor-fuel demand at a much higher rate than had been anticipated. Crude production rose to 4,581,000 barrels daily, imports increased to 359,000 barrels daily, and crude runs went up to 4,609,000 barrels daily. In adjusting supply to demand, by products, the yield of gasoline was reduced, and fuel-oil and kerosine yields were increased.

The total demand for all oils in 1946 probably will be 1 to 2 percent less than the war peak of 1945—a much larger total demand than was anticipated, Presumably, exports will continue to decline with cessation of war requirements abroad, the increased prices of domestic crude oil, and the problem of international exchange. Within the United States the transition from war requirements to civilian uses has been rapid.

Although the total demand for motor fuel may be somewhat less in 1946 than in 1945, domestic demand may exceed all previous records. Contemplated military purchases of motor fuel will be less than 3 percent of the total domestic demand in 1946, and the increment will be in civilian usage.

The compilation, by the Public Roads Administration, of data from State tax records furnishes the best source of information on the consumption of motor fuel for highway or automotive use. Comparative figures indicate that this automotive demand amounted to 576 million barrels in 1941, 391 million in 1944, and 456 million in 1945. Preliminary forecasts of automotive demand in 1946 were based on the assumption that the reduced number of vehicles would result in a total automotive demand considerably below the 1941 peak. Data available for the first half of the year, however, would indicate that automotive demand for motor fuel in 1946 may be considerably greater than in 1941.

The domestic demand for residual fuel oil in 1946 may be considerably less than in 1945, due to the reduction in naval purchases. The expansion in civilian demand may be retarded by difficulties in securing new oil installations and materials for reconversion. The removal of rationing restrictions should result in a return to the normal volume of light heating oils required with prospects of a rapid increase in the number of new installations.

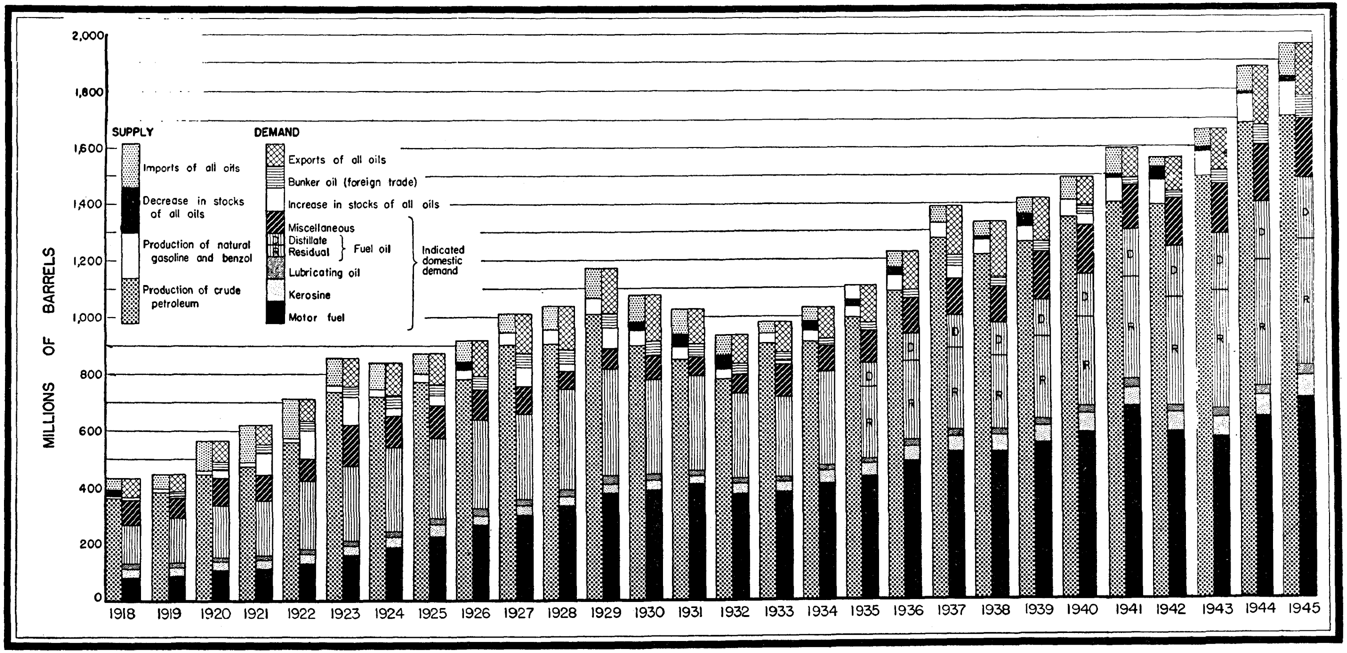

FIGURE 1.—Supply and demand of all oils in the United States, 1918–45.

ADMINISTRATION

In the early months of 1945 demand on the United States for all oils reached record levels and taxed the facilities of the Petroleum Administration for War and the petroleum industry to meet, world-wide, the urgent needs of the United Nations in the final stages of the war. With the surrender of Germany in May, a major problem of coordination of supply and transportation of petroleum and products was posed by the shift in emphasis from the European to the Asiatic theater of military operations. It was necessary to curtail the eastward movement and direct all available means to augment the rapid flow of products westward to the Pacific through the Panama Canal and overland through West coast ports until the surrender of Japan in August.

Prompt action was taken to remove controls over the petroleum industry upon the end of hostilities. The day after the surrender of Japan, August 15, 1945, rationing of gasoline and fuel oils was ended, and wartime restrictions upon gasoline quality and most refining operations were removed. On August 23 most of the distribution and marketing regulations were rescinded. Many of the controls over petroleum supply and transportation were canceled on August 27, and regulations covering well spacing in the oil and natural-gas fields expired on September 1, as did limitations on construction in all branches of the industry. By October 15 all domestic orders had been terminated and those affecting foreign operations became void by November 1.

By Executive order of the President the Petroleum Administration for War was terminated, effective May 8, 1946. Shortly thereafter, however, a new Oil and Gas Division was organized in the Department of the Interior to undertake a program, recommended by the President, of coordination of Government activities with respect to petroleum and natural gas and to serve as a liaison agency of the Federal Government in its relations with appropriate State bodies and the petroleum industry.

RESERVES

The American Petroleum Institute Committee on Petroleum Reserves estimated proved reserves of crude oil in the United States on January 1, 1946, at 20,826,813,000 barrels. These reserves include crude oil and condensate in known and proved fields recoverable under existing economic and operating conditions. Additions to reserves during 1945 totaled 2,110,299,000 barrels and represented 419,984,000 barrels from new pools discovered during the year and 1,690,315,000 barrels due to upward revisions of reserve estimates for fields discovered before 1945. The increase in total reserves amounted to 374 million barrels during 1945.

The largest gains in reserves were 171 million barrels for Colorado. 117 million for Louisiana, 95 million for Texas. 66 million for California and 58 million for Mississippi. The greatest declines in reserves were 80 million barrels for Oklahoma, 60 million for Kansas, 51 million for New Mexico, and a total of 20 million in the Appalachian States—Pennsylvania, New York, and West Virginia.

Estimates of proved oil reserves in the United States on January 1, 1940-46, by States [1]

[Millions of barrels]

State	1940	1941	1942	1943	1944	1945	1946
Eastern States:							
Illinois	382	315	334	307	295	321	350
Indiana	14	14	23	32	31	31	41
Kentucky	44	41	36	35	35	41	57
Michigan	51	35	56	64	55	65	64
New York	35	65	60	54	90	86	81
Ohio	32	30	37	35	33	32	30
Pennsylvania	183	188	171	153	137	123	110
West Virginia	46	53	50	47	44	41	39
	787	741	767	727	720	740	772
Central and Southern States:							
Arkansas	320	306	295	300	297	293	304
Kansas	726	692	690	687	646	602	542
Louisiana	1, 173	1, 216	1, 330	1, 442	1, 484	1, 573	1, 690
Mississippi	7	40	80	41	39	209	267
New Mexico	687	692	675	677	654	563	512
Oklahoma	1, 063	1, 002	1, 036	969	909	970	890
Texas	9, 768	10, 624	10, 976	11, 546	11, 325	11, 375	11, 470
	13, 744	14, 572	15, 082	15, 662	15, 354	15, 585	15, 675
Mountain States:							
Colorado	20	23	23	39	45	89	260
Montana	94	89	86	86	108	112	108
Wyoming	306	305	304	371	499	582	600
	420	417	413	496	652	783	968
Pacific Coast States: California	3, 532	3, 291	3, 323	3, 196	3, 337	3, 344	3, 410
Other States	-------	4	4	2	1	1	2
Total United States	18, 483	19, 025	19, 589	20, 083	20, 064	20, 453	20, 827

[1] From reports of Committee on Petroleum Reserves, American Petroleum Institute, of the amount of crude oil that may be extracted by present methods from fields completely developed or sufficiently explored to permit reasonably accurate calculations. The change in reserves during any year represents total new discoveries, extensions, and revisions, minus production.

WORLD OIL SUPPLY

The world production of crude petroleum exceeded all previous records in 1945, increasing from 2,614 million barrels in 1944 to 2,625 million in 1945. A gain of 2 percent in the United States more than offset a decline of 2 percent in other producing countries. The United States produced 64 percent of the total in 1944 and 65 percent in 1945.

World production was 539 million barrels greater in 1945 than in 1939. The principal changes in world production (comparing 1939 with 1945) have been a gain of 446 million barrels for the United States, 117 million barrels for Venezuela, 51 million for Iran, and 17 million barrels for Saudi Arabia. Principal declines have been in Russia, Netherlands Indies, and Rumania. In North and South America, only relatively small changes in crude-oil production have occurred outside of the United States and Venezuela. In Europe the total decline is estimated at 70 million barrels, chiefly in Russia and Rumania, with moderate gains in other small producing countries. In Asia the total increase has been about 28 million barrels, with gains in Iran and Saudi Arabia partly offset by declines in Netherlands Indies and Burma.

Net exports (exports less imports) from the United States amounted to 130 million barrels in 1939 and 71 million in 1945. In 1946 imports probably will show a material gain and exports a decline, so that the net export will be comparatively small. If this trend continues, United States production may soon reach a point where it about balances domestic requirements.

The domestic demand for all oils in the United States has increased from 1,231 million barrels in 1939 to 1,768 million in 1945 and is estimated at about the same amount in 1946—a comparative gain from 1939 to 1946 of about 44 percent.

Crude production outside of the United States increased from 821 million barrels in 1939 to 914 million barrels in 1945—a gain of only 11 percent. Crude production outside of the United States plus the net exports of all oils from the United States would indicate a net supply for the rest of the world of 951 million barrels in 1939 and 985 million in 1945, exclusive of substitute oils produced. These figures indicate only a relatively small gain in oil consumption outside the United States in 1945 compared with 1939.

CRUDE PETROLEUM

SUPPLY AND DEMAND

The total demand for crude petroleum in 1945 amounted to 1,789 million barrels and exceeded the previous record of 1944 by almost 44 million barrels. The demand for domestic crude petroleum rose from 1,701 million barrels in 1944 to 1,715 million in 1945—a gain of 14 million barrels. The demand for imported crude oil rose from 44 million barrels in 1944 to 74 million in 1945—a gain of 30 million barrels.

Compared with 1944, the production of domestic crude petroleum in 1945 increased 33 million barrels, imports of crude oil were 29 million barrels greater, and total stocks of crude oil were reduced by only 4 million barrels compared with a decrease of 22 million barrels in 1944.

The principal changes in crude-oil demand were an increase of 54 million barrels in total runs to stills, a decline of 1 million barrels in crude exports, a decline of 8 million barrels in transfers of crude oil to fuel oils, and a decline of 1 million barrels in other crude fuel and losses.

Supply of and demand for crude petroleum in the United States, 1941–45

[Thousands of barrels]

	1941	1942	1943	1944	1945 [1]
Production	1,402,228	1,386,645	1,505,613	1,677,904	1,711,103
Imports [2]	50,606	12,297	13,833	44,805	74,095
Changes in stocks [3]	−18,937	−11,924	+6,041	−22,435	−3,511
Total supply	1,471,771	1,410,866	1,513,405	1,745,144	1,788,709
Runs to stills:					
Domestic	1,358,246	1,319,507	1,417,559	1,622,514	1,645,862
Foreign	50,946	14,596	12,179	43,170	73,672
Exports [2]	33,238	33,834	41,342	34,238	32,998
Transfers to fuel oil:					
Distillate	2,383	2,484	3,070	3,242	3,047
Residual	13,099	19,295	24,087	28,515	20,727
Other fuel and losses	13,859	21,150	15,168	13,465	12,403
Total demand	1,471,771	1,410,866	1,513,405	1,745,144	1,788,709

[1] Subject to revision.
[2] As reported to Bureau of Mines.
[3] Inclusive of heavy crude in California.

PRODUCTION

General.—The production of crude petroleum set a new record of 1,711,103,000 barrels in 1945—a gain of 33 million barrels or 2 percent compared with 1944. Production in 1945 was 309 million barrels greater than in 1941—a gain of 22 percent.

The principal gains in production in 1945 compared with 1944 were 15 million barrels for California, 13 million for Oklahoma, and 9 million for Texas. The largest declines were 3 million barrels for Kansas and 2 million for New Mexico and Illinois.

Texas and California retained their positions as the two leading States, with 44.1 and 19.1 percent of the total national output. Oklahoma ranked third in the list of producers with 8.1 percent, Louisiana fourth with 7.6 percent, Kansas fifth with 5.6 percent, and Illinois sixth with 4.4 percent.

Production in the East Texas field totaled 131,210,000 barrels in 1945—a decline of over 3 million barrels compared with 1944. In California production in the Wilmington field declined about 1 million barrels to 36,222,000 barrels in 1945, declined in the Coalinga field by 4 million barrels to 31,549,000 barrels, rose in Elk Hills 8 million barrels to 15,813,000 barrels, and increased 9 million barrels in Buena Vista Hills to 15,759,000 barrels. In Oklahoma, production in the West Edmond field rose to 26,548,000 barrels—a gain of almost 19 million barrels.

Petroleum produced in the United States, 1941-45, and total, 1859-1945, by States [1]

[Thousands of barrels]

	1941	1942	1943	1944	1945 [2]	1859-1945 (total)
Production:						
Alabama				43	181	224
Arkansas	26,327	26,628	27,600	29,418	28,613	645,003
California	230,263	248,326	284,188	311,793	326,482	6,971,130
Colorado	2,150	2,199	2,320	3,083	4,959	54,607
Illinois	132,393	106,391	82,260	77,413	75,210	1,173,339
Indiana	7,411	6,743	5,283	5,118	4,868	160,533
Kansas	83,242	97,636	106,178	98,762	95,997	[3] 1,602,748
Kentucky	4,762	4,534	7,883	9,621	10,325	[4] 204,286
Louisiana	115,908	115,785	123,592	129,645	130,566	1,675,485
Michigan	16,359	21,754	20,768	18,490	17,259	[5] 239,736
Mississippi	15,327	28,833	18,807	16,337	18,775	102,586
Montana	7,526	8,074	7,916	8,647	8,397	124,052
Nebraska	1,898	1,237	635	417	305	4,770
New Mexico	39,569	31,544	38,896	39,555	37,281	[6] 461,604
New York	5,185	5,421	5,059	4,697	4,648	[7] 143,787
Ohio	3,510	3,543	3,322	2,937	2,828	604,517
Oklahoma	154,702	140,690	123,152	124,616	138,036	5,487,319
Pennsylvania	16,750	17,779	15,757	14,118	12,515	1,073,987
Texas	505,572	483,097	594.343	746,699	755,533	9,665,051
West Virginia	3,433	3,574	3,349	3,070	2,879	427,075
Wyoming	29,878	32,812	34,253	33,356	35,359	666,636
Other States [8]	63	45	52	69	87	1,436
Total United States	1,402,228	1,386,645	1,505,613	1,677,904	1,711,103	31,489,911
Value at wells:						
Total (thousands of dollars)	1,602,000	1,643,470	1,809,020	2,032,960	2,093,300	37,524,129
Average per barrel	$1.14	$1.19	$1.20	$1.21	$1.21	$1.19

[1] For detailed figures by States, 1859-1935, see Minerals Yearbook, 1937, p. 1008.
[2] Subject to revision.
[3] Oklahoma included with Kansas in 1905 and 1906.
[4] Includes Tennessee, 1883-1907.
[5] Figures represent 1925-1945 production only; earlier years included under "Other States."
[6] Figures represent 1924-1945 production only; earlier years included under "Other States."
[7] Early production in New York included with Pennsylvania.
[8] Includes Alaska, 1912-33; Arkansas, 1920; Michigan, 1900-1919; Missouri, 1899-1911, 1913-16, 1919-23, 1932-45; New Mexico, 1913, 1919-23; Tennessee, 1916-45; Utah, 1907-11, 1920, 1924-41; Florida, 1943-45; Virginia, 1943-45.

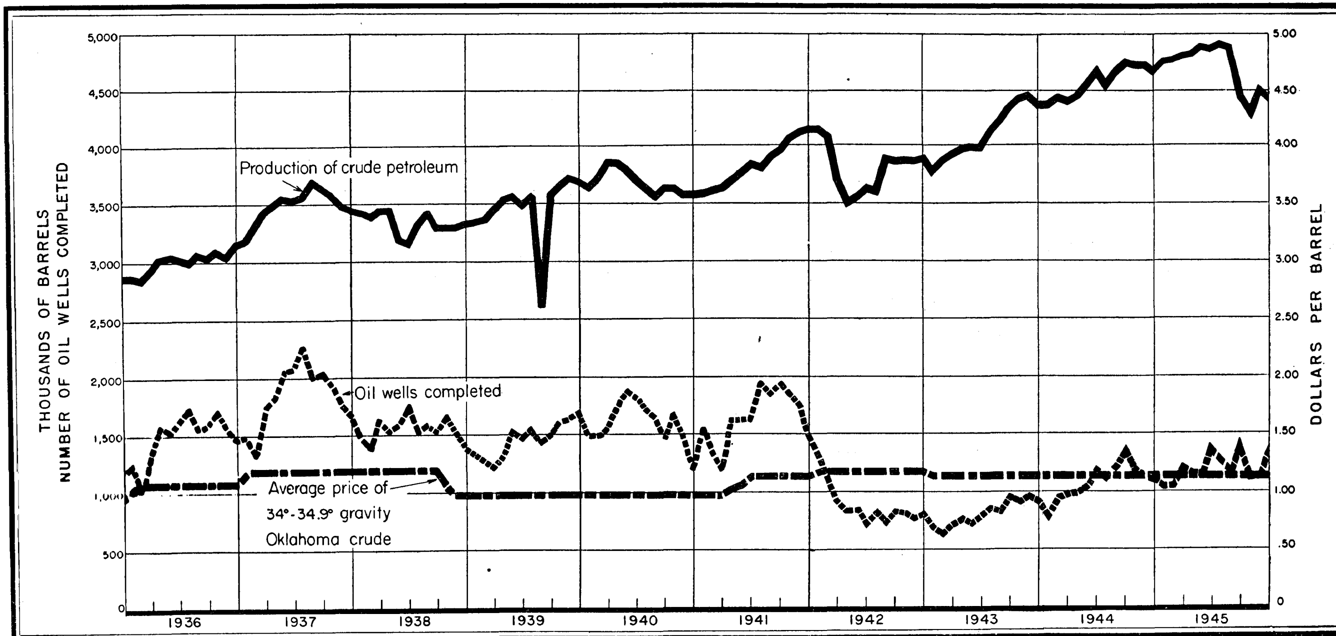

FIGURE 2.—Daily average production of crude petroleum, total number of wells completed, and average price per barrel of a selected grade of Oklahoma crude petroleum in the United States, 1935–45, by months.

Production of crude petroleum in the United States in 1944, by districts, States, and months

[Thousands of barrels]

District and State	1944 [1] January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,984	1,909	2,071	1,930	2,131	1,990	1,681	2,297	1,923	1,947	1,831	1,703	23,397
Other Appalachian [2]	803	762	836	749	863	861	866	1,005	974	1,067	1,079	1,010	10,875
Lima-Northeastern Indiana-Michigan	1,635	1,589	1,610	1,550	1,626	1,533	1,477	1,606	1,484	1,544	1,531	1,524	18,709
Illinois-Southwestern Indiana	7,198	6,811	7,152	6,775	7,037	6,669	6,779	6,971	6,685	6,961	6,701	6,768	82,507
Mid-Continent:													
North Louisiana, Arkansas, Alabama, and Mississippi	5,847	5,537	5,812	5,709	5,723	5,705	5,842	6,030	5,848	6,030	5,826	5,903	69,812
West Texas and Southeastern New Mexico	15,013	14,040	14,458	15,039	16,909	16,709	17,571	18,363	18,275	18,545	17,391	17,773	200,086
East Texas	11,453	11,362	11,358	10,793	11,265	10,578	11,210	11,666	11,167	11,641	11,118	11,573	135,184
Oklahoma, Kansas, North Texas, etc	33,169	31,616	34,237	32,932	35,124	34,046	34,667	35,711	35,057	36,016	35,450	35,571	413,596
Gulf Coast	29,546	27,760	29,872	29,378	31,019	30,087	31,150	31,374	30,867	31,754	31,429	32,149	366,385
Rocky Mountain	3,837	3,580	3,741	3,745	3,609	3,647	3,782	3,760	4,073	4,115	3,765	3,906	45,560
California [3]	25,197	23,876	25,667	24,988	25,883	25,438	26,413	26,624	26,632	27,291	26,342	27,442	311,793
Total United States	135,682	128,842	136,814	133,588	141,189	137,263	141,438	145,407	142,985	146,911	142,463	145,322	1,677,904
STATE													
Alabama				2	2	4	2	6	7	7	6	7	43
Arkansas	2,450	2,307	2,490	2,431	2,475	2,426	2,460	2,564	2,428	2,493	2,416	2,478	29,418
California [3]	25,197	23,876	25,667	24,988	25,883	25,438	26,413	26,624	26,632	27,291	26,342	27,442	311,793
Colorado	240	210	238	230	267	245	268	276	281	282	259	287	3,083
Illinois	6,783	6,391	6,704	6,340	6,614	6,263	6,375	6,539	6,261	6,519	6,275	6,349	77,413
Indiana	417	422	450	437	425	408	406	434	426	444	428	421	5,118
Kansas	8,360	7,954	8,497	7,826	8,606	8,310	8,177	8,425	8,104	8,213	8,203	8,087	98,762
Kentucky	695	663	720	647	748	759	783	886	870	969	969	912	9,621
Lousiana	10,704	10,306	10,951	10,695	11,026	10,626	10,838	11,048	10,720	11,128	10,718	10,885	129,645
Michigan	1,621	1,576	1,597	1,542	1,601	1,508	1,459	1,583	1,464	1,520	1,510	1,509	18,490
Mississippi	1,343	1,268	1,267	1,250	1,244	1,295	1,354	1,401	1,384	1,476	1,508	1,547	16,337
Montana	749	700	741	709	723	715	690	764	715	733	698	710	8,647
Nebraska	37	26	39	37	35	34	38	40	35	34	32	30	417
New Mexico	3,490	3,310	3,557	3,396	3,366	3,165	3,262	3,268	3,148	3,241	3,139	3,213	39,555
New York	387	381	399	375	419	402	332	480	392	393	376	361	4,697
Ohio	253	232	263	229	276	247	190	295	240	257	237	218	2,937
Oklahoma	10,111	9,611	10,533	9,987	10,477	9,984	10,150	10,470	10,504	10,913	10,860	11,016	124,616
Pennsylvania	1,202	1,149	1,264	1,183	1,292	1,206	1,032	1,367	1,160	1,151	1,098	1,014	14,118
Texas	58,561	55,560	58,435	58,261	62,846	61,316	64,195	65,959	64,925	66,518	64,379	65,744	746,699
West Virginia	259	254	270	249	280	258	224	293	252	264	248	219	3,070
Wyoming	2,816	2,640	2,726	2,769	2,578	2,649	2,784	2,679	3,032	3,059	2,757	2,867	33,356
Other States	7	6	6	5	6	5	6	6	5	6	5	6	[4] 69
Total United States: 1944	135,682	128,842	136,814	133,588	141,189	137,263	141,438	145,407	142,985	146,911	142,463	145,322	1,677,904
1943	117,372	108,487	121,648	119,100	123,957	120,111	127,629	130,796	130,564	136,837	133,824	135,288	1,505,613
Daily average, 1944	4,377	4,443	4,413	4,453	4,554	4,575	4,563	4,691	4,766	4,739	4,749	4,688	4,584

[1] Final figures. [2] Includes Florida, Kentucky, Tennessee, and Virginia. [3] American Petroleum Institute. [4] Florida (12), Missouri (45), Tennessee (9), and Virginia (3).

Production of crude petroleum in the United States in 1945, by districts, States, and months

[Thousands of barrels]

District and State	1945 [1] January	February	March	April	May	June	July	August	September	October	November	December	Total
DISTRICT													
Pennsylvania Grade	1,740	1,574	1,875	1,789	1,897	1,838	1,853	1,943	1,719	1,897	1,748	1,668	21,541
Other Appalachian [2]	991	878	775	932	1,013	964	995	1,003	909	999	1,068	979	11,506
Lima-Northeastern Indiana-Michigan	1,469	1,343	1,526	1,443	1,526	1,508	1,526	1,498	1,354	1,469	1,408	1,403	17,473
Illinois-Southwestern Indiana	6,792	6,260	6,747	6,508	6,911	6,627	6,829	6,892	6,132	6,815	6,679	6,862	80,054
Mid Continent:													
North Louisiana, Arkansas, Alabama, and Mississippi	5,967	5,539	6,000	5,776	6,022	5,842	6,064	6,057	5,787	6,019	5,882	6,203	71,158
West Texas and Southeastern New Mexico	18,120	16,073	18,413	18,035	18,663	17,990	19,368	19,378	16,124	15,728	16,948	17,713	212,553
East Texas	11,941	10,982	11,897	11,410	11,881	11,393	11,783	11,796	9,688	9,570	9,525	9,449	131,315
Oklahoma, Kansas, North Texas, etc	36,474	32,716	37,018	35,487	37,172	35,842	37,341	37,723	33,937	34,801	35,366	35,542	429,419
Gulf Coast	32,005	29,034	32,288	31,058	32,311	31,145	32,191	31,832	26,954	25,684	27,366	28,564	360,432
Rocky Mountain	4,019	3,701	4,199	4,067	4,382	4,213	4,473	4,327	3,791	3,962	4,014	4,022	49,170
California	27,668	25,138	28,020	27,520	29,207	28,248	29,183	28,516	25,991	25,653	25,248	26,090	326,482
Total United States	147,186	133,238	148,758	144,025	150,985	145,610	151,606	150,965	132,386	132,597	135,252	138,495	1,711,103
STATE													
Alabama	6	10	11	14	15	23	25	22	6	7	18	24	181
Arkansas	2,512	2,244	2,475	2,392	2,493	2,377	2,459	2,396	2,276	2,336	2,276	2,377	28,613
California [3]	27,668	25,138	28,020	27,520	29,207	28,248	29,183	28,516	25,991	25,653	25,248	26,090	326,482
Colorado	282	259	267	293	379	352	376	371	421	615	688	656	4,959
Illinois	6,369	5,875	6,389	6,151	6,486	6,222	6,403	6,452	5,747	6,400	6,279	6,437	75,210
Indiana	425	387	360	359	427	407	428	442	387	417	402	427	4,868
Kansas	8,318	7,379	8,478	7,968	8,298	8,039	8,292	8,232	7,832	8,126	7,669	7,366	95,997
Kentucky	911	791	665	837	905	850	893	886	814	898	982	893	10,325
Louisiana	10,758	9,962	10,992	10,564	11,137	10,833	11,167	11,220	10,591	11,028	10,991	11,323	130,566
Michigan	1,462	1,327	1,506	1,425	1,504	1,486	1,505	1,480	1,336	1,449	1,391	1,388	17,259
Mississippi	1,494	1,446	1,562	1,544	1,570	1,538	1,605	1,670	1,541	1,613	1,540	1,652	18,775
Montana	727	638	713	691	736	709	717	733	689	702	662	680	8,397
Nebraska	25	28	21	31	28	26	26	26	22	27	19	26	305
New Mexico	3,226	2,930	3,250	3,139	3,231	3,071	3,242	3,205	3,054	3,011	2,970	2,952	37,281
New York	363	329	386	382	417	386	395	431	377	421	394	367	4,648
Ohio	195	208	258	233	251	246	248	265	229	258	223	214	2,828
Oklahoma	11,278	10,146	11,483	11,226	11,860	11,508	11,915	12,060	11,517	11,436	11,750	11,857	138,036
Pennsylvania	1,015	919	1,096	1,043	1,109	1,097	1,082	1,111	996	1,089	995	963	12,515
Texas	66,933	60,234	67,373	64,925	67,459	64,826	68,052	67,989	55,684	54,255	57,887	59,916	755,533
West Virginia	251	218	261	236	246	238	242	264	223	244	236	220	2,879
Wyoming	2,966	2,766	3,185	3,042	3,221	3,119	3,340	3,185	2,645	2,603	2,626	2,661	35,359
Other States	2	4	7	10	6	9	11	9	8	9	6	6	[4] 87
Total United States:													
1945	147,186	133,238	148,758	144,025	150,985	145,610	151,606	150,965	132,386	132,597	135,252	138,495	1,711,103
1944	135,682	128,842	136,814	133,588	141,189	137,263	141,438	145,407	142,985	146,911	142,463	145,322	1,677,904
Daily average, 1945	4,748	4,759	4,799	4,801	4,870	4,854	4,891	4,870	4,413	4,277	4,508	4,468	4,688

[1] Subject to revision.
[2] Florida, Kentucky, Tennessee, and Virginia.
[3] American Petroleum Institute.
[4] Florida (30), Missouri (45), Tennessee (8), and Virginia (4).

Percentage of total crude petroleum produced in the United States, 1936–45, by principal States

State	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945 [1]
Texas	38.9	39.9	39.2	38.2	36.4	36.1	34.8	39.5	44.5	44.1
California	19.5	18.6	20.6	17.7	16.6	16.4	17.9	18.9	18.6	19.1
Oklahoma	18.8	17.9	14.4	12.7	11.5	11.0	10.2	8.2	7.4	8.1
Louisiana	7.3	7.1	7.8	7.4	7.7	8.3	8.3	8.2	7.7	7.6
Kansas	5.3	5.5	5.0	4.8	4.9	5.9	7.0	7.0	5.9	5.6
Illinois	.4	.6	2.0	7.5	10.9	9.4	7.7	5.5	4.6	4.4
New Mexico	2.5	3.1	2.9	3.0	2.9	2.8	2.3	2.6	2.4	2.2
Wyoming	1.3	1.5	1.6	1.7	1.9	2.1	2.4	2.3	2.0	2.1
Arkansas	.9	.9	1.5	1.7	1.9	1.9	1.9	1.8	1.8	1.7
Mississippi					.3	1.1	2.1	1.2	1.0	1.1
Michigan	1.1	1.3	1.5	1.8	1.5	1.2	1.6	1.4	1.1	1.0
Pennsylvania	1.6	1.5	1.4	1.4	1.3	1.2	1.3	1.0	.8	.7
All other	2.4	2.1	2.1	2.1	2.2	2.6	2.5	2.4	2.2	2.3
Total United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Subject to revision.

Production of crude petroleum in leading fields and districts in the United States, 1944–45, and total production since discovery [1]

[Thousands of barrels]

Field	State	1944	1945	Total since discovery
East Texas	Texas	134,674	131,210	2,226,504
Wilmington	California	36,943	36,222	281,478
Coalinga	do	35,404	31,549	504,314
West Edmond	Oklahoma	7,752	26,548	34,753
Slaughter	Texas	23,981	23,440	72,299
Wasson	do	24,500	23,256	102,160
Conroe	do	24,200	20,992	206,155
Hastings	do	21,800	20,608	106,295
Webster	do	20,600	19,820	64,512
Ventura Avenue	California	17,507	17,663	303,113
Huntington Beach	do	17,165	17,558	361,588
Elk Hills	do	7,719	15,813	191,064
Buena Vista Hills	do	6,897	15,759	315,373
Bradford-Allegany [2]	Pennsylvania-New York	16,535	15,036	527,199
Gray County	Texas	16,164	14,880	246,569
Midway-Sunset	California	15,179	14,373	690,338
Kattleman North Dome	do	15,128	14,349	310,052
Santa Maria Valley	do	11,281	13,538	63,034
Yates	Texas	13,005	13,053	300,880
Oklahoma City	Oklahoma	16,295	12,968	[3] 631,882
Thompson	Texas	13,475	12,749	[3] 85,050
Hawkins	do	13,449	12,210	46,666
Anahuac	do	11,700	10,923	55,378
Hutchinson County	do	12,034	10,872	200,412
McElroy	do	10,400	10,717	154,311
Van	do	11,651	10,494	161,597
North Cowden	do	9,280	9,997	47,215
Long Beach	California	10,858	9,803	712,419
Louden	Illinois	11,175	9,463	121,283
Tinsley	Mississippi	11,836	9,345	86,194
Goldsmith	Texas	8,625	8,381	63,601
Talco	do	8,601	8,284	83,805
Seminole	do	8,920	8,088	25,063
Monument	New Mexico	7,570	7,139	73,927
West Ranch	Texas	8,100	7,127	33,140
Belridge	California	6,350	6,979	86,973
Salem	Illinois	8,310	6,637	192,194
Keystone	Texas	2,340	6,535	20,198
Fullerton	do	2,700	6,478	9,745
Santa Fe Springs	California	6,838	6,258	502,820
Stowell	Texas	5,380	6,237	12,822
Old Ocean	do	5,450	5,936	34,846
Eunice	New Mexico	6,470	5,707	77,143
Lance Creek	Wyoming	6,660	5,463	69,123
Clay City	Illinois	4,890	5,104	41,861
Cut Bank	Montana	5,475	4,907	47,196
Salt Creek	Wyoming	4,810	4.499	317,664
Rodessa	Arkansas-Louisiana-Texas	4,840	4,169	150,339

[1] Oil and Gas Journal. [2] Bureau of Mines. [3] Revised figure.

Alabama.—Continued development of the Gilbertown area, discovered in 1944, resulted in the completion in 1945 of 15 oil wells, of which 11 were in the West Gilbertown field and 4 in the East Gilbertown field, discovered in September 1945. The production increased from 43,000 barrels in 1944 to 181,000 barrels in 1945. The oil from both fields is black, asphaltic base, with A. P. I. gravity 17° to 18°.

Completions numbered 42 in 1945, of which most were wildcats, compared with 38 in 1944.

The Alabama legislature passed an oil- and gas-conservation law in 1945 and established a State oil and gas board to promulgate and enforce rules and regulations under the law.

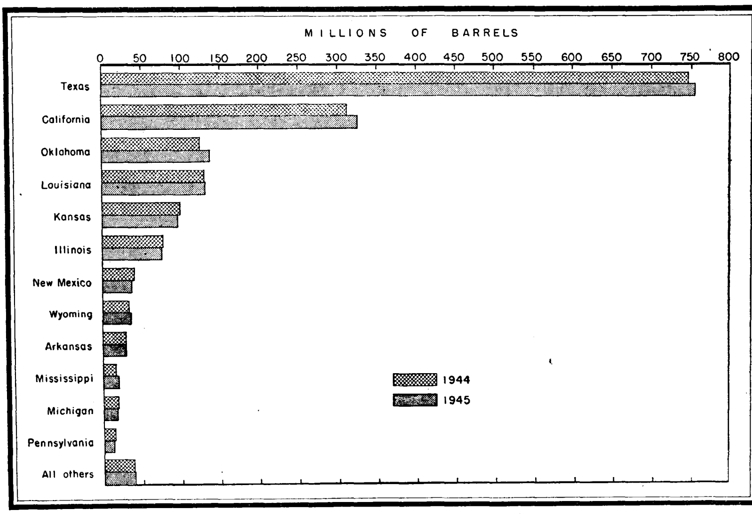

FIGURE 3.—Production of crude petroleum in the United States, 1944–45, by States.

Arkansas.—For the first time since 1936, production of crude petroleum declined in 1945 to 28,613,000 barrels from 29,418,000 barrels in 1944. Smaller output was reported from a number of fields, of which Magnolia, Dorcheat-Macedonia, and Schuler showed the greatest declines. Minor gains were reported at Midway, Stevens, and Atlanta.

Exploratory drilling declined sharply from the total of 70 wells completed in 1944 to 40 in 1945. Only 2 oil fields of small extent were discovered. These were the North Stevens field, Nevada County discovered in July by a well that pumped 50 barrels of oil daily from the Buckrange sand (Upper Cretaceous); and the Wesson field in southwestern Ouachita County, opened in September by completion of a well flowing 126 barrels per day through a ⅛-inch choke from a Lower Glenrose sand. Production from new horizons was developed in the Gum Creek (formerly New McDonald), Strong, and Stevens-Smart fields. The productive areas of several fields, including Atlanta, Fouke, McKamie, and Village, were enlarged by drilling, but none of these extensions appeared to have major importance.

Geophysical activity in exploration, as indicated by crew weeks worked, was notably higher in 1945 than in 1944 and covered many counties in central and northeastern Arkansas as well as those in the producing districts. The unproductive Desha Basin of southeastern Arkansas was extensively worked, and much of this area was leased by major oil companies.

The total number of completions declined from 215 in 1944 to 203 in 1945, of which 133 were oil wells, 8 gas wells, and 63 dry holes.

Production of crude petroleum in Arkansas, 1941–45, by fields

[Thousands of barrels]

Year	Atlanta	Buckner	Dorcheat-Macedonia	El Dorado	McKamie	Magnolia	Midway	Schuler	Smackover	Stephens	Urbana	Other fields	Total
1941	1,013	816	797	534	891	7,121	------	6,055	5,351	251	837	[1] 2,661	26,327
1942	1,034	765	1,012	497	723	6,364	1,218	5,913	4,907	614	985	[1] 2,596	26,628
1943	956	660	1,602	449	360	6,041	2,168	5,520	4,458	1,485	[3] 1,058	[1] 2,843	27,600
1944	1,164	666	2,345	416	1,107	5,592	2,382	5,105	4,280	1,828	[3] 1,019	[1] 3,514	29,418
1945 [2]	1,329	614	1,759	402	1,064	4,951	2,641	4,733	4,146	2,035	[3] 817	[1] 4,122	28,613

[1] Includes oil consumed on leases and net change in stocks held on leases for entire State.
[2] Subject to revision.
[3] Includes New London.

California.—Crude production increased from 311,793,000 barrels in 1944 to 326,482,000 barrels in 1945, a new record. Daily average output was about 915,000 barrels in the first 9 months of the year and dropped to 835,000 barrels in the last quarter as the demands of war declined. Production from the Elk Hills Naval Reserve had been sustained at a rate of 65,000 barrels daily until the end of hostilities in August, after which it was promptly cut back to about 15,000 barrels.

The San Joaquin Valley produced 161,131,000 barrels in 1945, a gain of 9 percent over 1944, owing to large increases from the Midway-Sunset and Elk Hills fields. During the emergency development at Elk Hills in 1944 and 1945, by the United States Navy, approximately 300 oil wells were completed.

The Coastal district produced 53,839,000 barrels in 1945 compared with 50,003,000 barrels in 1944. The Santa Maria Valley field output gained over 2,100,000 barrels over 1944, and smaller increases were reported from San Martinez and Ventura Avenue.

Small declines from a number of fields and the absence of large gains in any area caused production of the Los Angeles Basin to decline from 114,296,000 barrels in 1944 to 111,512,000 barrels in 1945.

The total demand for petroleum on the Pacific coast exceeded the local supply in 1945 because of the large-scale naval and military operations in the Pacific theater of war. As a result, 14,259,000 barrels of crude from Texas and Rocky Mountain fields were shipped by tank car into California in the first 11 months. This movement reached a peak in June, when 64,800 barrels daily reached the West coast.

Total well completions, surpassing the 1944 record by 5 percent, numbered 2,150, of which 1,690 were oil wells, 56 gas wells, and 404 dry holes. Exploration was heavily concentrated in Kern County, as indicated by 102 wildcat completions, of the State total of 235. Other active counties in exploration were: Los Angeles 35 completions, Solano 15, Fresno 12, Santa Barbara 12, and San Luis Obispo 10.

Production of crude petroleum in California, 1941–45, by districts and fields [1]

District and field	1941	1942	1943	1944	1945 [2]
San Joaquin Valley:					
Belridge	4,185	2,917	4,543	6,340	6,959
Canal	1,816	1,069	1,446	1,297	1,244
Coalinga	14,224	19,323	31,386	35,410	31,681
Coles Levee [3]	5,717	5,436	5,906	6,692	7,030
Edison	1,013	1,020	900	1,051	2,166
Elk Hills	3,491	4,363	5,373	7,719	15,805
Fruitvale	2,085	2,312	2,571	3,043	3,096
Greeley	2,480	2,583	4,819	5,219	5,062
Helm	3	81	166	499	1,211
Jacalitos	3	57	118	236	1,179
Kern River—Kern Front	4,315	5,707	7,274	8,440	8,210
Kettleman Hills	13,983	13,014	15,300	15,133	14,357
Lost Hills	1,263	1,398	1,328	1,284	1,228
McKittrick	1,422	1,791	1,719	1,851	2,043
Midway-Sunset [4]	17,461	20,470	20,227	22,065	30,106
Mountain View	1,910	1,602	1,394	1,156	1,024
Mount Poso	4,117	7,566	8,432	8,025	6,717
Pleasant Valley			235	935	1,309
Raisin City	63	305	382	936	1,163
Rio Bravo	4,534	3,579	5,446	5,920	5,743
Riverdale	2	93	590	1,517	1,540
Round Mountain	2,815	3,917	4,150	3,932	3,507
Ten Section	5,232	4,805	6,558	4,624	4,095
Other San Joaquin Valley	1,677	1,667	2,776	4,170	4,656
Total San Joaquin Valley	93,811	105,075	133,039	147,494	161,131
Coastal district:					
Aliso Canyon		715	755	1,100	1,156
Elwood	1,166	873	1,668	2,133	2,172
Gato Ridge		1,217	1,295	1,777	1,615
Rincon	1,542	1,010	1,210	1,501	1,689
San Martinez		237	473	855	1,196
San Miguelito	1,427	1,238	1,614	2,111	1,940
Santa Maria	3,183	2,726	3,791	4,892	5,038
Santa Maria Valley	6,908	7,550	8,303	11,358	13,489
Ventura Avenue	12,892	13,644	15,461	17,504	17,701
Ventura-Newhall	4,279	3,041	3,639	4,133	4,281
Other Coastal	827	1,697	2,312	2,639	3,562
Total Coastal	32,224	33,948	40,521	50,003	53,839
Los Angeles Basin:					
Brea Olinda	2,079	3,716	4,252	4,304	4,195
Coyote	4,466	5,848	6,502	6,434	7,105
Dominguez	8,495	7,932	9,118	7,879	6,726
Huntington Beach	10,743	12,096	13,239	17,162	17,587
Inglewood	4,901	6,750	6,913	6,467	5,624
Long Beach	14,697	13,131	11,641	10,862	9,851
Montebello	4,884	3,961	3,966	3,932	3,665
Richfield	2,719	2,890	2,689	2,564	2,741
Rosecrans	3,434	2,722	2,215	2,238	2,095
Santa Fe Springs	8,552	7,761	7,307	6,838	6,278
Seal Beach	2,430	3,027	2,867	2,835	3,426
Torrance	3,210	3,049	2,874	3,186	3,241
Wilmington	30,672	33,657	34,349	36,929	36,192
Other Los Angeles Basin	2,946	2,763	2,696	2,666	2,786
Total Los Angeles Basin	104,228	109,303	110,628	114,296	111,512
Total California	230,263	248,326	284,188	311,793	326,482

[1] American Petroleum Institute. [2] Subject to revision. [3] Includes Tupman. [4] Includes Buena Vista Hills.

Seven new oil fields were discovered, as follows: McDonald, Rosedale, and Santiago, producing from Miocene formations at depths of 850 to 4,870 feet, all in Kern County. Of these, the Santiago field appears to have greatest importance. Three discoveries were made in Los Angeles County also: Hasley Canyon, Sansinena, and Ramona. The seventh new field, West Mountain in Ventura County, produced from the Sespe formation at 4,501 to 5,450 feet.

The greatest additions to reserves apparently resulted from new zones and extensions to existing fields. In Kern County important new reserves were developed at Cymric and Elk Hills and in fractured basement schist at Edison. The schist-conglomerate zone in the Wilmington field was opened to large production possibilities. Reserves were added to over 40 fields during 1945; the total additions have been estimated as about 500 million barrels.

The Conservation Committee of California Oil Producers estimated the "maximum efficient rate" of crude-oil production from California oil fields on December 31, 1945, as 824,000 barrels per day.

Colorado.—Rapid expansion of production from the Rangely field, due to intensive development and the completion of a 10-inch pipe line to transport the oil to markets, was the principal factor in raising Colorado output 61 percent in 1945 to a new record of 4,959,000 barrels. Owing to a material gain in output in 1945, Wilson Creek remained the leading field of the State in production but doubtless will be surpassed in 1946 by Rangely, whose capacity and reserves are much greater.

Oil-well completions increased from 22 in 1944 to 42 in 1945, of which 29 were at Rangely, 7 at Wilson Creek, and 3 at North McCallum. Eighteen wildcat wells were completed, of which one produced oil (Rangely), one yielded gas (Powder Wash), and 16 were dry holes.

No new field discoveries were reported in 1945, but extensions at Rangely added to proved reserves an amount many times larger than the 1945 production of Colorado. Minor extensions were reported also at Powder Wash and North McCallum.

Production of crude petroleum in Colorado, 1941–45, by fields

[Thousands of barrels]

Year	Florence-Canon City	Fort Collins-Wellington	Hiawatha	Iles	Moffat	Price	Powder Wash	Rangely	Tow Creek	Wilson Creek	Other fields	Total
1941	55	118	191	547	116	324	42	220	50	453	[1] 34	2,150
1942	49	111	185	534	125	272	37	288	46	533	[1] 19	2,199
1943	44	102	164	480	118	253	44	285	46	760	[1] 24	2,320
1944	44	96	100	454	112	247	50	393	44	1,401	[1] 142	3,083
1945 [2]	43	143	66	429	105	238	67	1,540	38	2,053	[1] 237	4,959

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Subject to revision.

Florida.—A second producing well was completed in the Sunniland field, Collier County, about 1 mile north of the discovery well, in June 1945. It flowed about 200 barrels per day initially, with some salt water, from a depth of 11,597 feet in Lower Cretaceous rocks. Production of the field in 1945 was 30,000 barrels compared with 12,000 barrels in 1944.

Seventeen wells were completed in 1945 of which 16 were abandoned as dry holes. More than half the area of the State is said to be under lease for oil and gas.

Georgia.—Five exploratory wells were drilled in 1945 in the southeastern coastal plain section of the State. The deepest of these, in Atkinson County, attained a total depth of 4,296 feet and reached basement rocks, as did wells in Echols and Laurens Counties. Small shows of oil and gas were encountered, but none with promise of commercial production. Two wildcats were drilling at the end of the year.

Illinois.—Production declined 3 percent in 1945 to 75,210,000 barrels, continuing the trend that has persisted since the peak of 1940. Further declines in such leading fields as Salem, Louden, Dale-Hoodville, and New Harmony were not offset by scattered increases in output, of which the largest were at Bible Grove, Noble-Schnell, and Patoka. The latter field produced 1,574,000 barrels in 1945 under the stimulus of water-flood operations, a gain of 67 percent over 1944. Gas pressuring is practiced in a number of fields including Louden, Salem, Rural Hill, Griffen, Dahlgren and old Crawford and Laurence Counties' fields.

Oil-well completions numbered 1,079 in 1945 compared with 1,196 in 1944, amounting to 61 percent of total completions in both years. The most active fields with number of oil wells completed in 1945 were Clay City 110, Boyd 75, Mattoon 54, Bible Grove, 53, Albion 53, and Noble 40. A total of 460 wildcat wells was drilled, of which 73, or 16 percent, obtained oil production.

In all, 26 new fields were discovered, among which Brownsville, White County; Odin, Marion County; and Stamford, Clay County, were reported to have the greatest indicated reserves. Although several tests of Devonian and older formations were drilled, only one opened production in pre-Mississippian strata: Devonian production was found beneath an old Mississippian reservoir in the Woodlawn pool, Jefferson County. Late in 1945 the indicated trend of exploration was away from the active southeastern counties and toward and beyond the northern limits of the productive section of the State.

Production of crude petroleum in Illinois, 1941–45, by fields [1]

[Thousands of barrels]

Field	1941	1942	1943	1944	1945
	895	499	405	858	1,234
Benton	5,792	5,488	2,534	1,655	1,217
Bible Grove	------	286	763	985	1,757
Bridgeport	2,092	2,027	1,880	1,932	2,144
Centralia	3,564	2,277	1,683	1,785	1,729
Clay City	4,680	3,533	2,764	4,890	5,104
Dale-Hoodville	6,195	5,294	3,909	3,160	2,022
Dundas	4,438	2,505	1,295	780	873
Iola	------	18	1,003	1,085	724
Johnsonville	5,913	5,146	2,170	1,460	1,119
Keensburg	2,002	1,710	1,138	873	757
Louden	22,918	17,961	13,702	11,175	9,463
Mount Carmel	1,691	1,024	854	1,330	923
New Harmony	9,963	7,224	5,257	4,395	3,429
Noble and Schnell	2,521	2,699	2,601	2,165	2,739
Patoka	1,076	969	774	940	1,574
Phillipstown	56	182	1,112	985	1,244
Robinson	[2] 1,413	1,391	1,273	1,078	1,095
Roland	1,101	1,889	1,120	760	936
Rural Hill	1,570	3,738	1,715	925	679
Salem	29,539	14,705	10,220	8,310	6,637
Sims	12	1,706	1,488	965	1,008
St. James	1,871	1,477	1,130	930	796
Woodlawn	2,465	2,997	1,446	960	950
Other fields	16,864	19,537	18,493	21,441	23,307
Total Illinois	128,631	106,282	80,729	75,822	73,460

[1] Oil and Gas Journal.
[2] Includes Stoy in 1941.

Indiana.—Production amounted to 4,868,000 barrels in 1945 compared with 5,118,000 barrels in 1944 and the peak of recent years of 7,411,000 barrels in 1941. The fields of largest output in 1945 were: Griffen (1,722,000 barrels), New Harmony (464,000 barrels), and Mount Vernon (404,000 barrels): all in Posey County.

Oil-well completions declined from 144 in 1944 to 116 in 1945. Drilling was heavily concentrated in Gibson (40 oil wells) and Posey (35 oil wells) counties. Several Trenton oil wells were drilled in the Henderson field, Jay County.

Discovery of seven new pools was reported: 4 in Posey County, Crunk, Farmersville, Jeffries, and St. Wendells East; and 3 in Gibson County, Johnson West, Lysle, and Mount Carmel East. Extension of the New Harmony South pool on Mink Island in the Wabash River, and of the Owensville North pool (Gibson County) appears to have important possibilities of future development.

Production of crude petroleum in Indiana, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	627	572	642	619	648	644	656	627	595	600	566	615	7,411
1942	620	524	604	594	627	588	579	571	529	532	485	490	6,743
1943	482	441	458	451	427	435	460	440	434	425	414	416	5,283
1944	417	422	450	437	425	408	406	434	426	444	428	421	5,118
1945 [1]	425	387	360	359	427	407	428	442	387	417	402	427	4,868

[1] Subject to revision.

Kansas.—Crude production declined 3 percent in 1945 to 95,997,000 barrels owing to numerous declines of which the largest were in the Silica-Raymond, Carmi, Zenith, Chase, and Burnett fields. The Trapp-Sellens area, the State's largest producer, increased its output about 1.3 million barrels over 1944, aided by an active drilling program.

Oil-well completions numbered 838 compared with 824 in 1944. Of 1,796 reported completions of all types, 385 were listed as exploratory wells. The areas of greatest development with the number of oil-wells drilled in each were: Kraft-Prusa 67, Trapp 48, Virgil and North 45, the old El Dorado field 27, and Chitwood 23. The Hugoton gas field with 164 completions was the most active area in 1945.

A total of 34 discoveries was reported, the largest indicated area and reserves being the Ryan field in Rush County, producing from the Arbuckle limestone at a depth of 3,725 feet. Before the end of 1945, 23 producing wells had been completed in this field. Other relatively important discoveries were: Carroll and Behrens in Barton County, Faulkner in Graham County, and West Ray in Norton County. All reported discoveries were on, or in the vicinity of, the great northwest trend associated with the Barton arch structure, except the Livergood field in Brown County in the northeast corner of Kansas.

Production of crude petroleum in Kansas, 1941–45, by counties and selected fields [1]

[Thousands of barrels]

Field	1941	1942	1943	1944	1945
Bemis-Walters	4,866	5,847	6,720	5,268	5,507
Bornholdt [2]	1,783	1,857	1,830	1,591	1,412
Burnett	3,291	4,097	4,948	3,715	3,189
Burrton [3]	2,539	2,101	1,740	1,525	1,351
Carmi			662	2,067	1,161
Chase [4]	2,746	3,379	3,750	3,702	3,076
Genesee-Edwards	2,694	3,716	3,941	3,268	3,181
Gorham	2,426	2,734	2,528	2,286	2,068
Hall-Gurney	3,520	4,057	3,780	3,750	3,410
Kraft-Prusa-Feltes	1,596	3,233	4,158	4,086	4,590
Lindsborg	51	202	924	943	749
Morel	110	296	570	912	1,076
Peace Creek	36	1,650	2,914	1,638	1,305
Ray	175	731	1,140	1,172	1,147
Ritz Canton	1,366	1,145	960	864	742
Silica-Raymond	7,615	9,063	9,825	7,834	6,422
Stoltenberg-Wilkins	2,427	2,711	3,083	2,818	2,740
Trapp-Sellens	7,577	9,726	10,840	9,347	10,631
Voshell	586	535	630	630	589
Zenith	3,176	3,693	3,765	3,624	2,912
Other fields	33,841	36,206	36,989	38,817	39,238
Total Kansas	82,421	96,879	105,697	99,857	96,496

[1] Oil and Gas Journal.
[2] Included Welch prior to 1945.
[3] Includes Haury in 1945.
[4] Included Campbell prior to 1944.

Kentucky.—Production increased from 9,621,000 barrels in 1944 to a new record of 10,325,000 barrels in 1945, of which about 82 percent originated in Western Kentucky, 16 percent in Eastern Kentucky, and 2 percent in the old south-central producing area. The leading fields in production in 1945 were: Uniontown, Union County (3,091,000 barrels), Smith Mills, Henderson County (1,065,000 barrels), Poole Consolidated, Henderson County (1,006,000 barrels), and Hittesville Consolidated, Union County (636,000 barrels).

In Western Kentucky 292 oil wells were completed in 1945; 90 in Eastern Kentucky and perhaps 60 in the southern district, where activity has been increasing for several years. The most active oil fields in 1945, with the number of oil wells completed in each were: Uniontown 46, Poole 34, Waverly 32, and Dixie 27.

Eight fields were discovered, two in Union County, two in Henderson, and one each in Crittenden, Daviess, Ohio, and Todd Counties. The most important of these appear to be Dixie, Henderson County, producing chiefly from the Cypress sand at 2,300 feet; and Waverly, Union County, in which the principal producing horizon is also the Cypress at similar depth. New activity in Southern Kentucky has been encouraged by the extension of shallow Ordovician production in Clinton County.

Production of crude petroleum in Kentucky, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	424	387	414	407	403	385	418	386	391	397	356	394	4,762
1942	344	335	376	356	348	355	361	337	357	408	460	497	4,534
1943	476	513	526	564	640	664	737	732	774	825	759	673	7,883
1944	695	663	720	647	748	759	783	886	870	969	969	912	9,621
1945 [1]	911	791	665	837	905	850	893	896	814	898	982	893	10,325

[1] Subject to revision.

Louisiana.—A slight gain in production in 1945 to 130,566,000 barrels exceeded the former record output of 129,645,000 barrels made in 1944. These figures do not include liquids extracted from gas at cycle and natural gasoline plants. Since 1942 declines in production of the Northern district have been offset by larger increases in the Gulf district. The largest gains in output were reported from the following Gulf fields: West Tepetate, Delta Farms, Tepetate, Vinton, and Goodhope. Among the Northern district fields, Lake St. John and Delhi had the largest increases over 1944. Haynesville declined almost 1.5 million barrels in 1945, a sharp decline similar to that in 1944, and material declines continued at Olla, Rodessa, and Nebo.

Oil-well completions in the Gulf district were 310 in 1944 and 407 in 1945, of which 24 were classed as wildcat and 383 development wells. The most active fields were Erath (24 oil wells), Delta Farms (23), Egan (20), West Tepetate (20), and Good Hope (16). In the Northern district drilling increased sharply above the level of 1944, resulting in 239 oil-well completions compared with 119 in 1944. Nine of the 1945 completions were wildcats and 230 development wells. Delhi, discovered in 1944 as the first oil field in northeastern Louisiana, was the most active field in the State in 1945, with 62 new oil wells added. Other active Northern fields in 1945 were: Bellevue with 36 new oil wells, Lake St. John 29, Big Creek 20, and Caddo 18.

The 93 exploratory wells drilled in the Northern district in 1945 discovered 5 oil fields: Big Creek and West Delhi in Richland Parish, Lamar in Franklin, North Shongaloo in Webster, and Sailes in Bienville. In the West Delhi field, 15 wells were completed by the end of 1945 flowing high-gravity oil (40°) from Tuscaloosa and Paluxy sands. Development joined this new reserve with the Delhi field. Five condensate and one dry-gas field were also discovered in 1945.

In the Gulf district 74 wildcat wells resulted in the discovery of 10 oil fields and 3 condensate fields, scattered from Beauregard and Cameron Parishes on the west to Jefferson Parish on the east. One or more dry holes were subsequently completed near several of the discoveries, tending to limit the probabilities of large reserves. Weeks Island, a condensate discovery in Iberia Parish, may have large potentialities, and two oil discoveries; Bon Air, Jefferson Davis Parish, and Oretta, Beauregard Parish, appear to have prospects of substantial reserves.

Production of crude petroleum in Louisiana, 1941–45, by districts and fields

[Thousands of barrels]

District and field	1941	1942	1943	1944	1945 [1]
Gulf Coast:					
Anse la Butte	1,446	2,235	2,191	2,620	2,481
Barataria	989	1,081	1,129	1,135	1,367
Bayou Sale	121	943	1,908	3,112	2,903
Black Bayou	838	895	1,101	1,019	686
Bosco	1,494	1,375	1,094	1,046	1,000
Caillou Island	2,002	1,519	1,829	1,939	1,917
Chacahoula	489	618	937	937	754
Chalkley	1,680	1,514	1,496	1,254	1,037
Charenton	1,849	1,380	1,116	1,040	1,048
Delta Farms	151	309	1,013	2,218	3,372
East White Lake	76	217	562	1,044	1,219
Eola	3,668	3,313	3,137	3,158	2,467
Garden Island	1,225	1,256	1,357	1,256	1,139

See footnotes at end of table.

Production of crude petroleum in Louisiana, 1941–45, by districts and fields—Con.

[Thousands of barrels]

District and field	1941	1942	1943	1944	1945 [1]
Gulf Coast—Continued					
Gibson	1,407	1,324	2,543	3,542	3,384
Golden Meadows	4,814	4,424	3,606	2,796	2,494
Grand Bay	2,022	2,010	2,522	2,724	3,033
Grand Lake	1,625	1,153	951	841	733
Gueydan	694	1,048	1,504	1,963	2,071
Hackberry	3,768	3,316	3,725	4,057	3,776
Iowa	3,400	2,506	2,928	3,309	2,731
Jennings	4,991	4,402	3,416	2,840	2,442
Lafitte	4,523	3,750	4,688	4,452	4,139
Lake Salvador	611	718	988	1,554	1,595
Leeville	1,597	981	1,214	1,421	1,575
Neale	834	884	1,333	2,342	2,301
New Iberia	2,760	2,287	2,606	2,615	2,152
North Crowley	2,004	1,803	1,699	1,624	1,648
Paradis	1,085	2,246	4,173	4,013	3,652
Pine Prairie	240	842	1,402	1,944	1,942
Port Barre	1,025	965	1,215	1,176	1,008
Quarantine Bay	2,311	2,107	2,567	2,877	2,977
Roanoke	851	612	600	764	836
St. Gabriel	554	1,345	1,732	1,957	1,911
Sulphur	921	700	801	741	792
Tepetate (inc. north and west)	1,481	1,000	912	901	1,931
University	3,591	3,289	2,896	2,338	1,982
Venice	1,163	1,294	2,147	3,334	3,315
Ville Platte	6,119	6,446	4,450	3,642	2,502
Vinton	323	369	661	1,942	2,703
West Bay	408	743	878	1,055	1,222
West Lake Verrett	646	872	837	1,015	1,004
White Castle	922	907	1,271	1,437	1,250
Other Gulf Coast	[2] 18,199	[2] 15,477	[2] 17,059	[2] 18,637	[2] 22,486
Total Gulf Coast	90,917	86,475	96,194	105,631	106,977
Northern:					
Caddo	3,077	2,694	2,421	2,129	1,950
Cotton Valley	3,459	2,033	1,532	724	388
Haynesville	956	4,621	5,368	3,816	2,356
Homer	1,033	1,060	1,067	1,019	976
Lake St. John		62	306	623	1,882
Nebo [3]	974	3,424	3,668	3,466	3,191
Olla [4]	4,641	6,107	4,852	4,221	3,636
Rodessa	5,212	4,100	3,462	2,930	2,515
Shreveport	1,011	923	777	690	513
Urania	832	778	739	678	632
Other Northern	[2] 3,796	[2] 3,508	[2] 3,206	[2] 3,718	[2] 5,550
Total Northern	24,991	29,310	27,398	24,014	23,589
Total Louisiana	115,908	115,785	123,592	129,645	130,566

[1] Subject to revision.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Includes Hemphill, Trout Creek, and Jena.
[4] Includes Little Creek and Summerville.

Michigan.—Production decreased for the third successive year—from 18,490,000 barrels in 1944 to 17,267,000 barrels in 1945—owing to the dearth of major new developments. Material declines in output of Reed City, Headquarters, and other fields, were not compensated by gains in the recently developed Coldwater, Deep River, Fork, and Essexville areas.

Completion of 267 oil wells in 1945 compared with 239 in 1944. A total of 770 completions was reported, of which 289 were exploratory and 481 field development wells. The most intensively developed fields, with the number of oil wells completed in 1945, were: Coldwater 46, Deep River 45, Essexville 20, Fillmore 20, and East Norwich 18.

Fifteen oil fields were discovered in 1945, none of which appears at present to be large. The more promising among them are Douglas, Montcalm County, and Harrison, Clare County, producing from the Dundee formation; and Rockford, Kent County, and Ashton, Osceola County, producing from Traverse limestone.

Seismograph and gravimeter surveys were used in 1945 in connection with the search for favorable structural conditions; in addition, 203 shallow tests were drilled through the glacial drift to determine the elevation and attitude of underlying strata that could be identified as "markers."

Production of crude petroleum in Michigan, 1941–45, by fields [1]

[Thousands of barrels]

Year	Adams	Cold-water	Deep River	Fork	Head-quar-ters	Kaw-kaw-lin	Porter	Red-ding	Reed City	Win-ter field	Other fields	Total
1941	1,118				315	185	1,136	1,749	2,754	1,101	8,001	16,359
1942	1,030			53	2,321	492	891	740	9,102	1,259	5,866	21,754
1943	984			805	1,999	689	742	423	7,847	683	6,596	20,768
1944	1,177	68	736	1,436	1,212	724	626	312	5,194	377	6,628	18,490
1945	1,196	958	1,460	1,566	461	654	521	249	4,267	223	5,712	[2] 17,267

[1] Data from Department of Conservation, Michigan.
[2] Final figure.

Mississippi.—Following 2 years of decline, production increased in 1945 to 18,775,000 barrels from 16,337,000 barrels in 1944 as the output of recently developed fields increased. Tinsley production declined from 11,803,000 barrels (72 percent of the State total) in 1944 to 9,400,000 barrels (50 percent of total) in 1945. The Cranfield and Eucutta yields, according to information supplied by the Mississippi Oil and Gas Engineering Committee, produced 2,098,000 and 2,085,000 barrels, respectively, in 1945, about four times their 1944 output. Heidelberg gained from 1,441,000 barrels in 1944 to 2,894,000 barrels in 1945. Lesser gains in 1945 were reported from several fields.

Oil-well completions were 78 in 1944 and 198 in 1945, of which 6 were exploratory and 192 development wells. Completions of oil wells in the most active fields were: Eucutta 58, Heidelberg 52, Cranfield 31, and Langsdale 16.

Three oil fields were discovered: Langsdale, Clarke County, an important reserve; Fayette, Jefferson County; and Quitman, Clarke County. The Carthage Point, Soso, and Hub condensate fields were also opened. Extensions by outpost drilling were reported at Cranfield, Baxterville, and Eucutta.

Production of crude petroleum in Mississippi, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	551	603	570	770	901	858	1,425	1,598	1,694	1,932	2,240	2,185	15,327
1942	2,489	2,601	2,708	2,885	2,648	2,531	2,469	2,366	2,194	2,126	1,953	1,863	28,833
1943	1,766	1,589	1,639	1,679	1,655	1,612	1,585	1,574	1,470	1,438	1,408	1,392	18,807
1944	1,343	1,268	1,267	1,250	1,244	1,295	1,354	1,401	1,384	1,476	1,508	1,547	16,337
1945 [1]	1,494	1,446	1,562	1,544	1,570	1,538	1,605	1,670	1,541	1,613	1,540	1,652	18,775

[1] Subject to revision.

Montana.—Production declined from 8,627,000 barrels in 1944 because of the reduction of 557,000 barrels in runs from Cut Bank. This field has dominated Montana crude output for a number of years, accounting for 65 percent of the total in 1944 and 58 percent in 1945. The Montana portion of the Elk Basin field, the State's third largest source of oil, had the greatest gain in output (254,000 barrels) in 1945, as active development of the Tensleep sand continued. The comparatively small Dry Creek production increased 80 percent, apparently reflecting the 1944 discovery of oil in the Morrison formation.

Oil-well completions numbered 217, compared with 221 in 1944. The most active fields in 1945, with oil wells completed in each, were: Cut Bank 92, Kevin-Sunburst 84, Elk Basin 12, High Gravity 8, and Pondera 5. Of 35 wells classed as wildcats, 10 found oil production and 25 were dry holes.

Oil was discovered in Madison limestone at 1,650 feet, northwest of the Devon gas field, Toole County. A discovery of great potential importance was reported in the completion of the first oil well producing from Madison limestone in the Cut Bank area. The old Cat Creek field, Petroleum County, was revived by completion of a 300-barrel well in an Ellis sand, opening a new pool that was actively developed.

Production of crude petroleum in Montana, 1941–45, by fields

[Thousands of barrels]

Year	Cat Creek	Cut Bank	Dry Creek	Elk Basin	Frannie	Kevin-Sunburst	Lake Basin	Pondera	Other fields	Total
1941	173	5,020	170	17	26	1,753	17	286	[1] 64	7,526
1942	138	5,509	110	16	21	1,992	13	264	[1] 11	8,074
1943	120	5,328	97	243	14	1,840	16	211	[1] 47	7,916
1944	116	5,414	92	682	15	1,923	13	241	[1] 131	8,627
1945 [2]	130	4,857	166	936	19	1,908	8	262	[1] 111	8,397

[1] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.
[2] Subject to revision.

Nebraska.—Production in 1945 amounted to 305,000 barrels, compared with 417,000 barrels in 1944, continuing the decline that has persisted since the brief peak in output of 1941. The Falls City field accounted for 191,000 barrels of the 1945 total, Barada 106,000 barrels, and Dawson and Shubert the remainder. All producing fields are in Richardson County.

A further decline in drilling was indicated with 13 completions reported, of which 6 were in Richardson County and 3 in the northwestern section of the State. No discoveries or extensions to producing areas were made. The only producing well was completed in the Dawson field, making 30 barrels per day initially from Hunton limestone with a high percentage of water.

Production of crude petroleum in Nebraska, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	123	101	113	132	131	134	160	193	216	221	205	169	1,898
1942	115	117	122	118	116	113	104	99	90	87	78	78	1,237
1943	66	61	71	62	62	56	52	52	49	37	36	31	635
1944	37	26	39	37	35	34	38	40	35	34	32	30	417
1945 [1]	25	28	21	31	28	26	26	26	22	27	19	26	305

[1] Subject to revision.

New Mexico.—Production declined 6 percent in 1945 to 37,281,000 barrels, as output from all leading fields was reduced. Monument, Eunice, Vacuum, and Hobbs continued to be the major sources of production.

The number of oil-well completions changed only from 283 in 1944 to 279 in 1945. All of the 1945 wells were in the southeastern part of the State, 10 being classed as wildcats in Lea County and 269 field-development wells. Oil wells added in the most active fields were as follows: Grayburg-Jackson 35, Lovington West 24, Square Lake 23, Red Lake 17, and Caprock 16. The average depth of wells drilled was greater in 1945 than in 1944 and previous years, influenced by development of deeper production, chiefly in lower Permian horizons, in several fields. The deepest test ever drilled in New Mexico was abandoned as a dry hole at total depth of 13,998 feet in Pennsylvanian formation. It was located 1 mile from the Maljamar field, Lea County.

A major discovery was indicated by opening of the Paddock pool in April, 4 miles north of the important Drinkard pool, a 1944 discovery. Production was obtained from Glorietta and Yeso limestones of Permian age. In the Drinkard field substantial additions to reserves were made by development of new production from Clearfork and Wichita-Albany formations.

New Mexico's second Ellenburger limestone discovery was made in September, in the Skelly-Penrose area, by a large well that produced from a depth of 8,059 to 8,140 feet. Apparently, it is an important discovery. In the same area, new reserves in producing formations of Permian age were discovered.

Production of crude petroleum in New Mexico, 1941–45, by districts and fields [1]

[Thousands of barrels]

Year	Southeast									North-west	Total
	Arrow-head	Eunice	Gray-burg-Jackson	Hobbs	Loco Hills	Malja-mar and South	Monu-ment	Vac-uum	Other		
1941	1,429	6,658	1,627	3,686	2,308	1,651	6,960	4,800	10,335	206	39,660
1942	1,195	5,242	1,566	2,928	1,583	1,740	6,698	3,443	8,317	280	32,992
1943	1,703	6,498	1,914	3,780	1,296	1,853	7,190	4,953	9,312	425	38,924
1944	1,946	6,470	1,983	4,120	1,119	2,117	7,570	5,080	8,898	448	39,751
1945	1,839	5,707	1,952	3,874	993	[2] 2,086	7,139	4,585	9,056	[3] 455	37,686

[1] Oil and Gas Journal. [2] Oil Weekly. [3] Bureau of Mines.

New York.—The declining trend of production in 1943 and 1944 appears to have been arrested, at least temporarily, in 1945 as total output amounted to 4,648,000 barrels, compared with 4,697,000 barrels in 1944.

Drilling in 1945 was moderately below the 1944 rate. Oil-well completions numbered 723, or 65 fewer than in 1944, and water-input wells declined to 408 from 446 in 1944. A few unsuccessful attempts were made to enlarge productive areas of old fields in Allegany and Cattaraugus Counties, and some wildcatting activity was reported in southeastern Chautauqua County.

A deep well at Arcade, Wyoming County, reached a depth of over 7,100 feet in early 1946, having penetrated the Potsdam sandstone and encountered below it previously unknown dolomite and sandstone formations of probable Cambrian age.

Production of crude petroleum in New York, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	424	372	410	436	435	422	456	438	445	465	414	468	5,185
1942	453	405	454	458	455	467	474	456	459	461	425	454	5,421
1943	418	389	453	427	432	436	438	429	423	403	401	410	5,059
1944	387	381	399	375	419	402	332	480	392	393	376	361	4,697
1945 [1]	363	329	386	382	417	386	395	431	377	421	394	367	4,648

[1] Subject to revision.

Ohio.—In common with the other eastern producing States whose output is from stripper wells and secondary recovery operations, Ohio registered a peak in output in 1942 that has been followed by a declining trend. In 1945 production of 2,828,000 barrels was 4 percent below 1944 and 20 percent below 1942. Most of the 1945 production decline was in the Pennsylvania Grade oil.

Oil-well completions gained from 210 in 1944 to 248 in 1945, according to the Oil Weekly. Almost half the new oil wells produced from the Clinton sand, about one-quarter from sands above the Berea sand, and about one-fifth from the Berea. Oil development was most active in the following counties, in order: Muskingum, Perry, Washington, Meigs, Monroe, and Ashland.

No discoveries of new oil were reported in 1945, but a number of extensions to proved fields were made, notably to Clinton production in Muskingum and Perry Counties and to Berea production in Meigs County. A small Big Injun sand pool was opened at Stafford, Monroe County.

Production of crude petroleum in Ohio, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	278	255	273	294	300	297	298	286	300	316	289	324	3,510
1942	277	262	296	317	297	322	319	297	300	308	280	268	3,543
1943	253	244	293	273	278	285	286	303	278	274	276	279	3,322
1944	253	232	263	229	276	247	190	295	240	257	237	218	2,937
1945 [1]	195	208	258	233	251	246	248	265	229	258	223	214	2,828

[1] Subject to revision.

Oklahoma.—The upward trend in production, begun in 1944, continued through 1945, when the total output (138,036,000 barrels) was 11 percent above 1944. Output of the West Edmond field, north of Oklahoma City, increased from 7,752,000 barrels in 1944 to 26,548,000 barrels in 1945, or more than the State as a whole. Gains of about 1 million barrels each at Cement and Moore were accompanied by losses of over 3 million barrels at Oklahoma City and 1 million in the old Hewitt field. Principal fields in the Seminole district continued slow declines.

Oil-well completions were sharply higher for the second year, increasing from 1,031 in 1944 to 1,426 in 1945, influenced by concentrated drilling at West Edmond, which resulted in a gain from 256 to 390 oil wells in that great field. At the end of 1945, West Edmond had approximately 700 oil wells in a productive area of 31,500 acres, producing over 80,000 barrels daily of pipe-line oil (41° A. P. I. gravity). Of 471 exploratory completions in 1945, 86 were commercial oil wells, located in the following leading counties: Oklahoma 10, Logan 7, Stephens 7, and Garvin 5. After West Edmond, the fields with greatest number of oil completions were: Paul's Valley 59, Velma 45, Spaulding 37, Cement 37, Stroud 37, Cheyarha 36, Loco 36, and Lone Grove 27.

Much of the exploratory effort was directed toward structures in the eastern part of the great Anadarko Basin and resulted in several discoveries. The outstanding new field, on the basis of early indications, was North Lindsay, McClain County, in which production was found from the Wilcox sand below 10,950 feet. Other 1945 discoveries in the Anadarko Basin included the Chitwood pool, Grady County, producing condensate from a Pennsylvania sand at 10,880 feet; Northwest Cashion, Kingfisher County, producing from the Bois d'Arc section of the Hunton limestone at 7,064 to 7,095 feet; Bethany pool, Oklahoma County, producing condensate from the Bois d'Arc at 7,154 to 7,220 feet.

Of particular interest was the discovery of commercial oil production near Keyes, Cimarron County, west of the Hugoton gas production. The discovery well produced initially 140 barrels daily of 38° gravity oil from sand at 4,800 to 4,840 feet in the Cherokee formation.

Approximately 25 percent of the oil produced in 1945 qualified for payments under the OPA stripper-well program, which have been estimated to average about 31 cents a barrel. Seismograph activity was directed chiefly toward Western and South Central Oklahoma and is reported to have totaled 367 crew months of work, a 3-percent decline from the 1944 peak.

Although no new water-flood operations were reported in 1945, an increase in this type of secondary recovery is anticipated as materials and labor become less difficult to obtain and as a result of the provisions of the 1945 Compulsory Unitization Bill which fosters unit operation of oil and gas pools.

Production of crude petroleum in Oklahoma, 1941–45, by fields [1]

[Thousands of barrels]

Field	1941	1942	1943	1944	1945
Allen	1,780	1,365	1,245	1,285	1,256
Apache	274	1,740	2,309	2,245	2,308
Beebe	1,526	1,152	1,057	840	723
Billings	2,276	2,064	1,706	1,490	1,296
Bristow-Slick	1,951	1,777	1,658	785	643
Burbank	3,282	3,356	3,251	3,140	3,128
Cement	3,354	3,211	2,564	4,190	5,165
Coyle	1,468	1,660	1,627	1,185	991
Crescent	576	752	752	1,124	1,845
Cromwell	1,457	2,380	1,761	1,512	1,277
Cumberland	2,543	2,776	3,735	4,414	4,119
Cushing-Shamrock	3,223	3,069	2,991	2,940	2,814
Edmond	1,224	1,136	1,161	1,046	902
Fitts	4,223	3,050	2,489	2,150	1,701
Glenn-Sapulpa	1,483	1,527	1,856	2,245	2,359
Healdton	3,086	2,827	2,618	2,515	2,423
Hewitt	4,860	3,304	2,382	2,055	1,084
Keokuk	1,029	1,012	678	560	530
Lucien	2,067	1,877	1,575	1,363	994
Moore	327	291	261	552	1,648
Oklahoma City	32,184	26,484	20,338	16,295	12,968
Paul's Valley		823	1,963	4,200	4,445
Ramsey	1,549	1,664	1,590	1,250	999
Seminole district:					
Bowlegs	2,134	1,900	1,721	1,525	1,250
Carr City	791	662	602	555	514
Earlsboro	3,757	3,718	3,253	2,495	1,737
Konawa	1,245	670	521	465	464
Little River	2,705	2,333	1,931	1,741	1,492
St. Louis-Pearson	6,997	5,687	3,828	2,690	1,703
Seminole City	2,243	2,854	2,555	2,240	1,990
Sholem-Alechem-Tatums-Tussy	2,826	2,490	2,275	2,486	2,208
South Burbank	2,780	2,728	2,637	2,500	2,370
West Edmond			322	7,752	26,548
Other fields	52,037	44,422	39,347	39,606	43,485
Total Oklahoma	153,257	136,761	120,559	123,436	139,379

[1] Oil and Gas Journal.

Pennsylvania.—Production declined in 1945 for the third successive year to 12,515,000 barrels, 11 percent below the 1944 total and 30 percent below 1942. The Bradford-field production dropped 11 percent to 10,793,000 barrels, of which 963,000 barrels were produced in the New York State portion of the field.

According to the Oil Weekly, oil-well completions numbered 1,400, a reduction of 10 below 1944, and 1,227 water input wells were drilled, compared with 1,268 in 1944.

Two small oil fields were discovered in 1945. One, in Kent Hollow, Keating Township, McKean County, produced from Haskell sand. An area of about 600 productive acres was indicated by the 12 oil wells. The other oil pool, discovered in early 1945 in North Strabane Township, Washington County, produced from the Gordon sand and appeared to be about 150 acres in areal extent.

Production of crude petroleum in Pennsylvania, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	1,416	1,231	1,336	1,382	1,407	1,345	1,419	1,376	1,440	1,501	1,370	1,527	16,750
1942	1,501	1,332	1,518	1,582	1,522	1,560	1,526	1,508	1,481	1,502	1,359	1,388	17,779
1943	1,358	1,229	1,419	1,348	1,367	1,368	1,359	1,330	1,290	1,246	1,228	1,215	15,757
1944	1,202	1,149	1,264	1,183	1,292	1,206	1,032	1,367	1,160	1,151	1,098	1,014	14,118
1945 [1]	1,015	919	1,096	1,043	1,109	1,097	1,082	1,111	996	1,089	995	963	12,515

[1] Subject to revision.

Tennessee.—About 8,000 barrels of oil were produced in 1945, most of which was from Mississippi lime wells in Scott and Morgan Counties. Two wells each in Clay and Fentress Counties accounted for the remainder.

Six completions were reported in 1945, three in Fentress and one each in Cumberland, Jackson, and Haywood Counties. All were dry holes.

Texas.—Production increased 1 percent above the 1944 record to 755,533,000 barrels, although a sharp cut-back occurred after the end of hostilities in August. The principal gains in output were almost 15 million barrels in West Texas and 7 million in South Texas. Minor declines were recorded in the Gulf Coast, East Texas, and Panhandle districts where production from most major fields was reduced.

Oil-well completions increased from 3,526 in 1944 to 4,036 in 1945, or 15 percent, owing principally to greater activity in West Texas, the Gulf Coast and North and West Central districts. A total of 1,552 wildcat completions resulted in 228 oil discoveries concentrated heavily in the Gulf Coast, West, and North Texas.

Moderately reduced output characterized most Gulf Coast fields in 1945, the principal exceptions being Fannette, Stowell, Old Ocean, and Withers-Magnet, which continued upward trends of several years duration.

Oil-well completions increased 26 percent over 1944 to 1,013, the rate of completions tending to increase in the late months of the year. The most active fields with oil wells added in each were Seeligson 106, Willamar 69, Stratton 42, Tijerina 40, and Livingston 35.

Over 50 new fields were discovered in 1945, of which about one-third produced from the Wilcox formation, a smaller proportion from the Frio, and a few from Cockfield-Yegua horizons. In addition, a number of new pays and extensions to productive acreage were developed. Several deep tests in old fields were drilled to explore possibilities below formations currently producing. Indications were found of porous sand bodies and limestone strata at depth that are expected to encourage further prospecting. One of these holes, on Millican dome, Brazos County, reached a record depth of 16,655 feet.

The gain in West Texas production to a new record of 175,727,000 barrels in 1945 was influenced by Andrews County, which doubled its output to 14,383,000 barrels through intensive development at Fullerton, Means, and other fields; and Winkler County, where the Keystone area contributed materially to a gain of 4 million barrels of production.

West Texas oil-well completions were 1,309 in 1945 compared with 1,323 in 1944. The following were the most active fields and the number of oil wells completed in each: Fullerton 208, Slaughter 165, Keystone 87, North Ward 47, TXL 41, and Cowden 41.

Exploratory drilling resulted in the discovery of 26 new fields, of which 7 produced from Devonian, 2 from Ellenburger limestone, 1 from Waddell sand (Ordovician), and the remaining 16 from Permian formations. Most of the important recent discoveries produce from rocks of greater age than the Permian, and this is expected to be generally true of new discoveries in this area for a number of years. Large new reserves were developed in the Ellenburger limestone by deep drilling in the Todd Deep field, Crockett County; TXL field, Ector County; and Fullerton field, Andrews County. Field extensions of major importance were reported at TXL (Devonian), Slaughter (San Andres), Fullerton (Devonian), and Mabel (San Andres), among others. The deepest producing well in West Texas was completed in November as the discovery well of the Jones Ranch field, Gaines County, 4½ miles southwest of the Wasson field. The well produces from Devonian formation at 11,422 feet.

Production of the East Texas district declined about 5 million barrels in 1945 to 179,124,000 barrels, as output of the East Texas field was reduced almost 4 million barrels to 131,315,000 barrels. Gains in output of the relatively young New Hope and Quitman fields failed to offset declines in other areas.

Oil-well completions totaled 157, an increase of 33 over 1944, owing in part to the drilling of 42 wells in the Hawkins field. Sixteen oil wells at New Hope, 11 at Pickton, and 8 at Sand Flat indicated the other active development areas, except the great Carthage field, which had 2 oil wells and 91 condensate wells added.

Only two small oil fields and four condensate fields were discovered in 1945. Myrtle Springs, Van Zant County, a January discovery, produces oil from the Travis Peak below 8,500 feet. The other oil field, La Rue in Henderson County, was discovered also in January by a well that produced initially 260 barrels from the Bacon sand of the lower Glen Rose. The four condensate fields are Fairfield and Teague in Freestone County, producing from Travis Peak sand and Pettit limestone, respectively; and Whelan and Marshall in Harrison County, producing from Dees sand and Pettit limestone of the lower Glen Rose formation.

Production in North and Central Texas continued in 1945 the upward trend of recent years. Drilling activity increased about 15 percent in 1945 and resulted in completion of over 1,000 oil wells. Oil-well completions in most active fields were: Electra 85, K. M. A. 66, Thornberry 49, Ellis 48, and Hildreth 39.

Active exploration discovered over 40 new fields, many of which were in Jones, Shackelford, Young, Archer, and Jack Counties. The most promising discoveries appeared to be National, Wilbarger County; Johnson, Montague County; and Belcherville, Montague County. Much of the exploratory effort in recent years has been directed toward horizons in Mississippian and Ordovician rocks at greater depths than the older producing reservoirs in strata of Pennsylvanian age.

Panhandle production declined 5 percent in 1945 to 31,726,000 barrels. Oil-well completions numbered 176 compared with 227 in 1944. Only 7 wildcats, all dry holes, were reported, scattered in 6 counties. Emphasis in drilling was upon developing gas-productive capacity.

Production of crude petroleum in Texas, 1941–45, by districts and fields

[Thousands of barrels]

District and field	1941	1942	1943	1944	1945 [1]
Gulf Coast:					
Agua Dulce	714	795	1,904	3,511	3,811
Amelia	1,220	1,375	1,668	1,682	1,491
Anahuac	4,657	3,589	8,906	11,932	11,168
Barbers Hill	3,076	2,879	2,340	2,069	1,895
Bay City	783	589	1,222	1,761	1,425
Clear Lake	605	647	1,468	1,872	1,424
Conroe	11,630	13,514	19,967	23,231	21,378
Dickinson-Gillock	2,191	2,073	2,128	2,377	2,138
Fairbanks	2,932	2,784	2,802	2,910	2,644
Fannette	457	457	1,242	1,657	2,692
Fig Ridge	41	237	862	2,516	2,862
Flour Bluff	1,336	426	1,009	1,490	1,435
Friendswood	2,959	3,615	11,420	20,930	20,075
Goose Creek	509	484	388	414	445
Greta	2,357	1,132	1,499	3,375	3,233
Hardin	1,659	1,091	1,372	1,330	1,157
Hastings	7,623	10,412	17,964	22,169	20,961
Heyser	2,633	2,926	3,337	3,338	2,807
High Island	985	880	805	839	868
Hull	2,387	2,217	1,879	1,645	1,472
La Rosa	1,058	365	676	1,681	1,469
Lolita	1,454	2,269	1,887	2,146	2,283
Lovell's Lake	1,334	1,784	2,040	1,891	1,765
Luby	1,396	782	1,276	1,581	1,315
Manvel	1,915	1,906	2,665	3,024	2,824
Markham	455	531	973	2,409	2,403
Midway	618	873	1,082	1,198	1,230
Old Ocean	4,741	3,701	4,785	5,517	6,107
Oyster Bayou	37	134	1,222	2,267	2,088
Placedo	1,401	1,228	1,730	2,265	2,324
Raccoon Bend	1,329	1,587	2,646	3,675	3,375
Refugio	2,223	1,542	1,509	1,839	1,918
Saxet-Saxet Heights	4,578	2,728	2,677	2,685	2,142
Segno	1,538	1,290	1,599	1,394	1,355
South Houston	788	667	1,586	1,865	1,785
Stowell	2	257	1,747	5,522	6,330
Stratton	754	683	1,732	4,090	4,016
Sugarland	647	614	1,779	3,084	2,448
Thompsons	4,609	5,392	9,993	13,609	13,007
Tomball	3,314	3,146	3,257	3,781	3,728
West Columbia	2,740	1,984	2,041	2,584	2,595
West Ranch	3,691	5,249	6,762	8,102	7,122
White Point	2,864	2,934	3,905	4,537	4,525
Withers-Magnet	2,829	4,165	6,015	6,749	7,391
Other Gulf Coast	[2] 37,663	[2] 37,087	[2] 50,362	[2] 62,211	[2] 62,529
Total Gulf Coast	134,732	135,020	200,128	260,754	253,455
East Texas:					
East Texas proper [3]	132,486	122,799	129,983	135,184	131,315
Cayuga	4,303	4,066	3,459	2,998	2,633
Chapel Hill	480	979	1,293	1,245	774
Hawkins	1,432	5,451	14,243	13,178	12,436
Long Lake	1,342	1,463	1,558	1,995	2,042
New Hope			124	986	1,640
Quitman		3	642	2,083	2,158
Rodessa	4,712	3,166	2,821	2,209	1,716
Sulphur Bluff	1,582	1,549	1,510	1,426	1,338
Talco	9,038	9,522	9,266	8,618	8,248
Van	3,739	3,444	6,411	11,673	10,968
Other East Texas	846	840	1,515	2,725	3,856
Total East Texas	159,960	153,282	172,825	184,320	179,124
Central Texas:					
Darst Creek	1,845	2,220	2,779	3,438	3,188
Luling	1,974	1,754	1,645	1,551	1,469
Mexia-Powell [4]	1,531	1,480	1,339	1,290	1,209
Salt Flat (Bruner)	1,348	1,118	909	817	672
Other Central Texas	2,897	1,954	2,760	5,319	6,226
Total Central Texas	9,595	8,526	9,432	12,415	12,764
North Texas [5]	[6] 48,529	[6] 49,932	[6] 50,159	[6] 53,272	[6] 54,260
Panhandle [7]	27,831	30,881	33,295	33,435	31,726
South Texas [8]	32,018	23,681	29,285	41,498	48,477

See footnotes at end of table.

Production of crude petroleum in Texas, 1941–45, by districts and fields—Continued

[Thousands of dollars]

District and field	1941	1942	1943	1944	1945 [1]
West Texas:					
Andrews	2, 224	1, 345	2, 008	7, 129	14, 383
Crane-Upton	9, 920	9, 628	11, 598	17, 028	18, 476
Crockett	827	919	1, 187	1, 469	2, 020
Ector [9]	23, 486	16, 132	20, 303	33, 635	34, 180
Fisher	655	572	475	434	324
Gaines-Yoakum	15, 731	11, 530	15, 785	33, 785	32, 909
Glasscock-Howard-Mitchell	7, 202	7, 165	7, 008	7, 332	7, 599
Pecos	8, 391	9, 808	12, 288	16, 785	17, 238
Reagan	1, 951	1, 931	2, 006	2, 456	3, 011
Slaughter	4, 612	7, 403	11, 267	23, 222	24, 119
Ward	7, 189	5, 890	5, 734	7, 153	6, 919
Winkler	9, 962	8, 690	8, 921	9, 712	13, 787
Other West Texas	[2] 757	[2] 762	[2] 639	[2] 865	[2] 762
Total West Texas	92, 907	81, 775	99, 219	161, 005	175, 727
Total Texas	505, 572	483, 097	594, 343	746, 699	755, 533

[1] Subject to revision.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire district.
[3] Joiner, Kilgore, Lathrop, and other pools in Cherokee, Gregg, Rusk, Smith, and Upshur Counties.
[4] Includes other fields in Falls, Freestone, Limestone, and Navarro Counties.
[5] Includes the fields in and between Wilbarger, Wichita, Clay, Montague, and Cooke Counties on the north and Runnels, Coleman, Brown, and Comanche Counties on the south.
[6] Includes crude oil consumed on leases and net change in stocks held on leases for East (exclusive of East Texas proper) Central, North, and South Texas.
[7] Carson, Gray, Hutchinson, Moore, and Wheeler Counties.
[8] Includes fields in Brooks, Duval, Hidalgo, Jim Hogg, Jim Wells, La Salle, Live Oak, McMullen, Starr, Webb, and Zapata Counties.
[9] Includes the part of Jordan pool in Crane County.

West Virginia.—Production of 2,879,000 barrels of crude petroleum was 6 percent below 1944 and 19 percent below the 1942 peak.

According to a report by David B. Reger, Morgantown, W. Va., oil-well completions were 80 in 1945 and 71 in 1944. The most active counties with number of new oil wells in each were: Calhoun 23, Ritchie 10, Roane 9, Kanawha 8, Wood and Pleasants 5 each.

No discoveries of new oil were made, but the limits of 4 oil fields were extended. The most important extension was apparently to the Sycamore pool, Calhoun County, to which 15 Big Injun oil wells were added.

Production of crude petroleum in West Virginia, 1941–45, by months

[Thousands of barrels]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1941	286	249	276	300	290	280	297	283	289	311	270	302	3, 433
1942	294	267	310	313	297	306	306	305	310	321	267	278	3, 574
1943	296	261	295	285	272	298	281	278	274	278	264	267	3, 349
1944	259	254	270	249	280	258	224	293	252	264	248	219	3, 070
1945 [1]	251	218	261	236	246	238	242	264	223	244	236	220	2, 879

[1] Subject to revision.

Wyoming.—Production increased from 33,356,000 barrels in 1944 to 35,359,000 barrels in 1945, the highest figure since 1924. Chief production gains were at Byron-Garland, Hamilton Dome, Frannie, and Steamboat Butte. The output of Lance Creek decreased over 1 million barrels.

Oil-well completions numbered 162, compared with 167 in 1944. The oil wells added in active fields in 1945 were: Elk Basin 35, Oregon Basin 13, Garland 12, Lance Creek 12, and Salt Creek 10.

Three oil fields were discovered in 1945. South Elk Basin, in Park County, produced oil from the Tensleep sand at 6,975 feet and appears to be a relatively important discovery; Zimmerman Butte, in Hot Springs County, produced from the Embar formation at 4,313 feet; and Oil Mountain, in Natrona County, produced from Tensleep sand at 2,620 feet. Deeper oil-producing zones were developed at Bailey, Half Moon, and Lamb fields in the Tensleep sand, Golden Eagle in the Lakota sand, North Baxter Basin in the Nugget sand, and Sheldon in the Embar formation. Noteworthy additions to known crude reserves were made by extensions to the Steamboat Butte, Lost Soldier, and Little Buffalo Basin fields.

Seismograph field studies were actively pushed in 1945 with a high concentration of activity in the Green River and Powder River Basins. Less effort was directed toward surface geological work and magnetometer and core-drill prospecting.

Negotiations were pending in 1945 for unitization of several important oil fields, including Elk Basin, Grass Creek, La Barge, and Oregon Basin, but no agreements appear to have been reached.

Production of crude petroleum in Wyoming, 1941–45, by fields

[Thousands of barrels]

Year	Big Muddy	Byron-Garland	Cole Creek	Elk Basin	Frannie	Grass Creek	Hamilton Dome	La Barge	Lance Creek	Lost Soldier-Ferris-Wertz
1941	421	1,516	295	195	939	1,171	264	767	8,838	4,745
1942	402	2,163	372	156	1,013	1,524	445	767	7,857	5,118
1943	382	2,554	414	2,133	846	1,313	508	655	7,082	4,246
1944	504	2,534	514	2,885	1,092	993	470	585	6,535	3,441
1945 [1]	549	3,752	563	3,190	1,487	1,016	957	510	5,493	3,135

Year	Maverick Springs	Medicine Bow	Oregon Basin	Pilot Butte	Poison Spider-South Casper	Rock Creek	Salt Creek	Steamboat Butte	Other fields	Total
1941	490	245	3,197	2	251	952	5,146	--------	[2] 444	29,878
1942	750	231	4,711	175	236	933	5,004	--------	[2] 955	32,812
1943	566	229	5,345	464	262	911	4,820	219	[2] 1,304	34,253
1944	474	208	4,388	370	229	935	4,802	601	[2] 1,796	33,356
1945 [1]	324	190	4,454	260	233	841	4,578	1,017	[2] 2,810	35,359

[1] Subject to revision.
[2] Includes crude oil consumed on leases and net change in stocks held on leases for entire State.

WELLS

The number of wells drilled in the United States in 1945, including oil and gas wells and dry holes, increased from 23,106 in 1944 to 24,667 in 1945. This represents a 7-percent increase in 1945 compared with the 29-percent increase in 1944.

Oil-well completions rose 10 percent from 13,029 in 1944 to 14,297 in 1945, and dry holes increased from 7,010 in 1944 to 7,471 in 1945, but the number of gas wells completed dropped 5 percent from 3,067 in 1944 to 2,899 in 1945. The number of oil wells completed in 1945 represented 58 percent of the total wells drilled compared with 56.4 percent in 1944. Dry holes remained at 30.3 percent of the total, and gas-well completions accounted for 11.7 percent of the total in 1945 compared with 13.3 percent in 1944.

Wells drilled for oil and gas in the United States, 1944–45, by months [1]

Wells	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
													Number	Percent
1944														
Oil	784	948	974	982	1,041	1,184	1,120	1,209	1,357	1,191	1,139	1,100	13,029	56.4
Gas	217	196	219	205	228	265	253	271	323	284	325	281	3,067	13.3
Dry	473	511	501	550	560	634	630	646	694	611	605	595	7,010	30.3
Total	1,474	1,655	1,694	1,737	1,829	2,083	2,003	2,126	2,374	2,086	2,069	1,976	23,106	100.0
1945														
Oil	1,022	1,024	1,235	1,151	1,146	1,350	1,240	1,158	1,389	1,089	1,156	1,337	14,297	58.0
Gas	214	226	260	224	211	261	251	226	292	214	262	258	2,899	11.7
Dry	517	535	590	583	556	756	627	626	751	598	648	684	7,471	30.3
Total	1,753	1,785	2,085	1,958	1,913	2,367	2,118	2,010	2,432	1,901	2,066	2,279	24,667	100.0

Oil and Gas Journal east of California; American Petroleum Institute in California.

The total completions in Texas accounted for 29 percent of all wells drilled in the United States in 1945. This Texas total of 7,184 in 1945 represented a 25-percent increase over the 5,729 completions in 1944. The number of oil wells drilled in Texas rose from 3,526 in 1944 to 4,036 in 1945, gas-well completions increased from 268 in 1944 to 714 in 1945, and the number of dry holes increased from 1,935 in 1944 to 2,434 in 1945. Active drilling continued in Oklahoma, where the total completions rose from 1,890 in 1944 to 2,509 in 1945. This drilling produced 1,426 oil wells in 1945 compared with 1,031 in 1944. Louisiana had a drilling gain of 305 wells for the year and Mississippi an increase of 206 wells. The greatest decline in total completions was in the area comprising Pennsylvania, New York, Ohio, and West Virginia, where the total completions dropped from 5,410 in 1944 to 4,710 in 1945. The increase in the number of oil wells drilled in this area was more than offset by a sharp decline in gas-well and dry-hole completions. Other declines in total drilling were reported for Kentucky, Illinois, Montana, Kansas, and Arkansas.

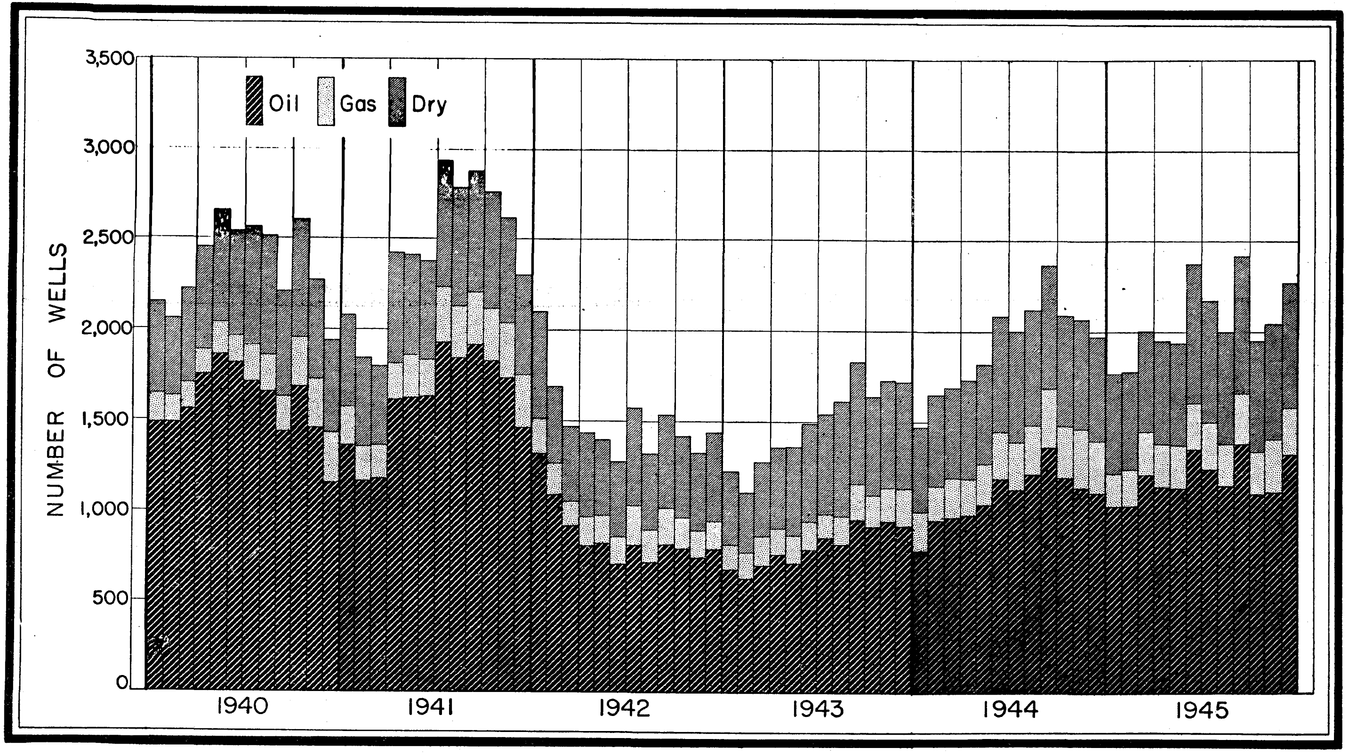

FIGURE 4.—Wells drilled in the United States, 1940–45, by months.

Wells drilled for oil and gas in the United States, 1944–45, by States and districts [1]

State and district	1944 Oil	1944 Gas	1944 Dry	1944 Total	1945 Oil	1945 Gas	1945 Dry	1945 Total
Alabama	10		24	34	13	1	23	37
Arkansas	128	2	85	215	115		70	185
California	1,663	48	323	2,034	1,690	56	404	2,150
Colorado	22	1	14	37	42	1	17	60
Illinois	1,196	6	747	1,949	1,060	1	688	1,749
Indiana	144	22	137	303	111	28	166	305
Kansas	824	93	920	1,837	838	201	745	1,784
Kentucky	374	305	314	993	382	108	247	737
Louisiana:								
Gulf Coast	310	15	149	474	407	19	189	615
Northern	119	67	143	329	239	89	165	493
Total Louisiana	429	82	292	803	646	108	354	1,108
Michigan	239	59	357	655	260	54	454	768
Mississippi	78	1	77	156	198		164	362
Montana	221	63	103	387	217	38	57	312
Nebraska, Missouri, and Iowa	12	3	18	33	1	4	27	32
New Mexico	283	15	116	414	279	21	124	424
Oklahoma	1,031	212	647	1,890	1,426	250	833	2,509
Pennsylvania, New York, Ohio, and West Virginia	2,681	1,882	847	5,410	2,820	1,303	587	4,710
Texas:								
Gulf Coast	804	128	469	1,401	1,013	150	558	1,721
East Texas	124	29	155	308	157	115	125	397
West Texas	1,323	15	244	1,582	1,309	26	405	1,740
Rest of State	1,275	96	1,067	2,438	1,557	423	1,346	3,326
Total Texas	3,526	268	1,935	5,729	4,036	714	2,434	7,184
Wyoming	167	5	33	205	162	10	55	227
Other States	1		21	22	1	1	22	24
Total United States	13,029	3,067	7,010	23,106	14,297	2,899	7,471	24,667

[1] Oil and Gas Journal east of California; American Petroleum Institute in California.

Producing oil wells in the United States and average production per day in 1944, by States and districts [1]

State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)	State and district	Producing oil wells: Approximate number, Dec. 31	Producing oil wells: Average production per well per day (barrels)
Arkansas	3,250	25.1	New York	21,700	0.6
California	21,470	41.4	Ohio	20,800	.4
Colorado	230	38.3	Oklahoma	51,900	6.5
Illinois	24,600	8.7	Pennsylvania	83,300	.5
Indiana	2,050	6.9	Texas:		
Kansas	25,000	11.2	Gulf Coast	14,000	51.8
Kentucky	17,000	1.6	East Texas proper	24,800	14.8
Louisiana:			West Texas	17,000	26.6
Gulf Coast	3,360	88.7	Rest of State	46,500	11.2
Northern	4,100	16.0	Total Texas	102,300	20.1
Total Louisiana	7,460	48.2	West Virginia	16,750	.5
Michigan	3,400	14.9	Wyoming	3,900	24.0
Mississippi	470	106.3	Other States [2]	110	1.7
Montana	2,200	11.1	Total United States	412,220	11.2
Nebraska	80	13.4			
New Mexico	4,250	26.3			

[1] Figures for 1945 not yet available.
[2] Alabama, Florida, Missouri, Tennessee, and Virginia.

STOCKS

Total stocks of crude petroleum amounted to 223,259,000 barrels on December 31, 1945, compared with 226,770,000 barrels on January 1, 1945. Stocks of foreign crude oil increased by 0.5 million barrels during the year, and stocks of domestic origin declined by 4 million barrels. The principal changes in stocks of domestic crude by States or origin were declines of 9.5 million barrels for Texas crude and 3 million barrels for all grades of California crude and increases of 3.9 million barrels in stocks of Oklahoma origin, 2.2 million for Illinois crude, 1.3 million for Mississippi crude, and 1.1 million for Louisiana crude.

Total stocks of crude petroleum on December 31, 1945, were about 51 million barrels less than on December 31, 1940. The major decreases during this 5-year period, by States of origin, have been 29 million barrels for Oklahoma, 22 million for California, 8 million for Wyoming, and 5 million for Illinois. The principal increase has been about 16 million barrels in stocks of Texas origin.

Stocks of crude petroleum, natural gasoline, and refined products in the United States at end of year, 1941–45

[Thousands of barrels]

Product	1941	1942	1943	1944	1945 [1]
Crude petroleum (refinable):					
At refineries	51,319	43,620	47,719	48,576 [2] 48,377	50,276
Pipe line and tank farm	183,992	177,904	181,422	158,181	153,957
Producers	12,188	13,365	14,365 [2] 12,991	14,105	14,530
Total refinable	247,499	234,889	243,506 [2] 242,132	220,862 [2] 220,663	218,763
California heavy crude	10,179	10,865	8,289 [2] 7,272	6,107	4,496
Total crude petroleum	257,678	245,754	251,795 [2] 249,404	226,969 [2] 226,770	223,259
Natural gasoline	4,437	4,632	4,541	4,252 [2] 4,451	4,322
Refined products [3]	294,310	247,554	229,362	245,868	235,998
Grand total	556,425	497,940	485,698 [2] 483,307	477,089	463,579

[1] Final figures.
[2] For comparison with succeeding years.
[3] Includes equivalents for wax, coke, and asphalt in barrels.

The relative significance of the volume of crude oil in storage has changed materially, considering the fact that the total demand for crude petroleum was about 22 percent greater in 1945 than in 1941, and that the available shut-in production declined greatly during the war period. The stocks of crude oil also must be considered in relation to the stocks of refined products. Total stocks of refined products have declined from 281 million barrels at the end of 1940 to 236 million barrels at the end of 1945. Stocks of refined declined 18 million barrels in 1943, increased 17 million barrels in 1944, and declined about 10 million barrels in 1945.

Stocks of crude petroleum in the United States in 1945, by States of location and by months [1]

[Thousands of barrels]

State	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
LOCATION													
Arkansas	2,926	2,777	2,696	2,720	2,565	2,629	2,547	2,518	2,505	2,385	1,635	1,710	1,761
California and Washington	[2] 20,103	20,270	20,218	20,517	20,579	19,587	18,254	17,917	17,018	17,219	17,198	17,909	18,720
Colorado	404	377	422	371	506	629	579	531	471	496	540	644	583
Georgia, Florida, South Carolina, and Virginia	320	225	263	267	330	328	453	603	742	581	389	342	163
Illinois, Minnesota, and Wisconsin	14,390	13,894	13,922	13,768	13,903	13,793	14,136	14,116	13,933	15,011	15,080	15,228	16,066
Indiana	3,605	3,925	4,090	4,163	3,934	3,855	3,946	3,371	3,486	4,314	4,184	4,257	4,214
Kansas and Nebraska	7,929	8,166	8,171	8,247	8,477	7,979	8,027	8,158	8,071	8,485	8,786	8,869	8,356
Kentucky and Tennessee	1,984	2,047	1,742	1,983	1,732	1,845	1,893	1,933	1,917	2,057	2,404	2,301	2,073
Louisiana and Alabama	13,732	13,766	13,509	13,905	14,587	14,672	13,973	12,808	12,365	12,583	12,908	13,035	13,155
Maryland	1,001	1,111	838	933	940	1,126	832	1,169	1,335	1,158	1,157	1,431	769
Massachusetts and Rhode Island	924	974	927	967	1,060	1,055	1,023	1,350	1,354	712	831	730	776
Michigan	1,479	1,410	1,251	1,371	1,465	1,501	1,611	1,503	1,447	1,585	1,525	1,539	1,534
Mississippi	353	398	363	341	354	327	327	360	372	420	508	454	587
Missouri and Iowa	4,789	4,928	4,681	4,758	4,876	4,891	4,889	5,022	5,248	5,177	4,932	4,800	5,065
Montana	754	830	813	823	1,000	906	899	940	788	914	1,048	991	988
New Jersey	3,879	3,992	3,901	4,666	4,575	4,707	5,258	5,845	5,850	4,254	4,573	4,878	3,986
New Mexico	1,229	1,244	1,214	1,307	1,226	1,244	1,181	1,265	1,303	1,244	1,263	1,418	1,476
New York	1,222	1,008	929	882	962	984	820	966	981	1,110	994	1,076	1,359
Ohio	8,025	8,366	8,103	8,581	8,010	7,242	7,451	7,684	7,735	8,744	8,613	8,135	8,011
Oklahoma	30,771	30,767	30,367	31,378	31,772	32,297	32,632	32,112	32,922	32,389	31,643	31,752	31,844
Pennsylvania	7,718	6,701	6,867	7,190	7,078	7,858	7,637	7,697	6,882	8,009	7,031	6,073	6,128
Texas	86,699	88,648	88,872	89,131	88,759	87,721	84,122	82,955	82,292	85,492	88,304	85,330	84,815
Utah	225	179	187	165	138	132	132	160	186	148	124	145	261
West Virginia	1,031	1,036	935	897	780	863	969	971	1,001	1,077	1,022	869	880
Wyoming and Idaho	5,171	4,698	4,940	4,657	4,621	4,980	4,627	4,684	4,931	4,755	4,554	5,000	5,187
Total gasoline-bearing crude	[2] 220,663	221,737	220,221	223,988	224,229	223,151	218,218	216,638	215,135	220,319	221,246	218,916	218,763
Heavy crude in California	6,107	6,026	5,791	5,567	5,415	5,063	5,044	4,793	4,821	4,437	4,606	4,610	4,496
Total crude petroleum in the United States	[2] 226,770	227,763	226,012	229,555	229,644	228,214	223,262	221,431	219,956	224,756	225,852	223,526	223,259

[1] Final figures.
[2] New basis to compare with subsequent months; a transfer oj 199,000 barrels of California condensate from crude oil stocks.

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Stocks of crude petroleum in the United States in 1945, by States of origin and by months [1]

[Thousands of barrels]

State	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
ORIGIN													
Alabama	10	12	17	23	21	25	24	37	57	51	49	24	40
Arkansas	3,165	3,008	2,877	2,820	2,727	2,810	2,843	2,683	2,842	2,465	2,432	2,539	2,506
California [2]	[3] 20,070	20,235	20,172	20,468	20,549	19,540	18,226	17,855	16,952	17,168	17,173	17,884	18,690
Colorado	345	324	311	280	340	437	437	367	338	358	318	489	566
Florida	16	12	6	2	2	3	6	9	10	8	7	5	4
Illinois	13,224	13,331	13,264	13,170	13,024	12,477	12,558	12,299	11,673	13,275	14,597	14,370	15,411
Indiana	282	223	174	113	163	165	147	103	120	143	122	188	195
Kansas, Nebraska	[4] 8,167	8,494	8,163	8,690	9,023	8,353	8,371	8,592	8,801	8,710	9,559	9,341	8,960
Kentucky	1,293	1,347	1,183	1,191	1,068	1,113	1,150	1,170	1,180	1,204	1,195	1,242	1,371
Louisiana	13,518	13,678	13,080	13,157	13,324	14,296	13,867	13,052	12,606	13,109	13,721	13,258	13,051
Michigan	1,080	992	922	993	1,015	1,041	1,145	1,102	1,117	1,137	1,103	1,124	1,137
Mississippi	1,071	1,314	1,381	1,494	1,400	1,060	983	1,514	1,424	1,702	2,561	2,441	2,319
Montana	725	765	713	734	902	819	805	914	722	831	935	904	904
New Mexico	6,593	6,669	6,673	6,747	6,338	6,414	6,118	5,650	5,898	6,118	6,289	5,956	5,966
New York	173	162	161	163	164	203	153	212	169	160	220	167	155
Ohio	479	442	576	569	447	493	539	505	574	529	547	520	488
Oklahoma	31,047	30,668	30,765	31,137	31,557	32,337	32,755	32,838	32,701	33,907	33,035	34,613	35,028
Pennsylvania	1,100	1,113	1,099	1,143	1,115	1,160	1,193	1,181	1,163	1,125	1,256	1,200	1,128
Texas	109,339	111,067	110,409	112,383	112,498	110,367	107,729	106,669	106,318	108,557	107,336	103,853	101,473
West Virginia	556	586	611	608	601	606	583	521	580	591	576	533	505
Wyoming	5,959	5,468	5,820	5,499	5,501	5,838	5,453	5,483	5,784	5,658	5,575	5,823	5,931
Foreign	2,451	1,827	1,844	2,604	2,450	3,594	3,133	3,882	4,106	3,513	2,640	2,442	2,935
Total gasoline-bearing crude	220,663	221,737	220,221	223,988	224,229	223,151	218,218	216,638	215,135	220,319	221,246	218,916	218,763
California heavy crude	6,107	6,026	5,791	5,567	5,415	5,063	5,044	4,793	4,821	4,437	4,606	4,610	4,496
	226,770	227,763	226,012	229,555	229,644	228,214	223,262	221,431	219,956	224,756	225,852	223,526	223,259

[1] Final figures.
[2] Heavy crude stocks in California given below.
[3] New basis to compare with subsequent months; a transfer of 199,000 barrels of California condensate from crude-oil stocks.
[4] Includes Missouri (2).

Stocks of crude petroleum [1] in the United States in 1945, by location and months

[Thousands of barrels]

Classification	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
At refineries:													
Arkansas	332	310	328	324	265	347	358	391	375	351	455	441	478
California and Washington	[2] 6,412	6,331	6,398	6,433	6,720	6,549	6,240	6,094	6,045	6,623	6,017	6,145	6,019
Georgia, Maryland, Massachusetts, Rhode Island, South Carolina and Virginia	2,229	2,298	2,022	2,165	2,328	2,506	2,302	3,113	3,421	2,443	2,370	2,498	1,704
Illinois, Minnesota, and Wisconsin	2,673	2,600	2,455	2,749	2,913	2,589	2,554	2,715	2,738	2,791	2,828	2,842	2,823
Indiana	1,597	1,645	1,605	1,772	1,559	1,565	1,760	1,374	1,258	1,652	1,552	1,697	1,467
Kansas and Nebraska	1,469	1,421	1,351	1,501	1,638	1,546	1,586	1,657	1,711	1,756	2,050	2,166	1,975
Kentucky and Tennessee	889	888	652	797	831	813	820	856	882	909	1,164	1,133	714
Louisiana and Mississippi	3,909	5,206	5,245	5,150	5,875	5,703	5,355	4,666	4,389	4,391	4,036	3,826	3,570
Michigan	509	521	414	461	526	549	630	569	481	627	543	462	460
Missouri	274	277	244	241	233	259	284	255	228	283	305	251	245
Montana and Colorado	482	554	601	547	765	851	819	821	656	748	865	872	769
New Jersey	3,481	3,584	3,445	4,152	4,072	4,281	4,733	5,456	5,370	4,018	4,331	4,605	3,805
New Mexico	59	53	49	61	40	43	48	50	49	46	59	60	69
New York	861	648	631	620	683	744	611	745	813	976	856	942	1,189
Ohio	1,324	1,299	1,342	1,370	1,114	996	1,304	1,662	1,627	1,940	1,432	1,653	1,790
Oklahoma	2,188	2,269	2,462	2,709	2,716	2,748	2,595	2,529	2,749	3,006	2,856	3,083	2,893
Pennsylvania	4,359	3,415	3,536	3,832	3,688	4,393	4,190	4,394	3,813	4,929	4,078	4,219	4,477
Texas	14,105	15,131	14,749	15,991	15,816	15,726	14,661	14,739	15,328	16,030	15,033	14,887	14,669
West Virginia	66	85	50	72	51	54	79	81	95	97	83	78	70
Wyoming, Idaho, and Utah	1,159	1,085	1,030	957	921	910	861	886	939	853	860	896	1,090
Total at refineries	48,377	49,620	48,609	51,904	52,754	53,172	51,790	53,053	52,967	54,469	51,773	52,756	50,276
Pipe-line and tank-farm stocks:													
Arkansas	2,154	2,027	1,953	1,971	1,865	1,857	1,789	1,712	1,725	1,629	775	874	868
California	10,001	10,074	9,969	10,088	9,832	9,000	7,971	7,964	7,148	6,759	7,259	8,017	8,831
Illinois and Indiana	13,030	12,909	13,287	12,765	12,695	12,839	13,113	12,748	12,778	14,142	14,229	14,296	15,310
Kansas and Nebraska	5,560	5,820	5,985	5,836	5,884	5,508	5,481	5,521	5,410	5,819	5,776	5,748	5,451
Kentucky and Tennessee	1,030	1,094	1,025	1,126	836	967	1,013	1,017	975	1,083	1,180	1,103	1,294
Louisiana, Alabama, and Mississippi	9,074	7,881	7,561	7,975	7,930	8,165	7,815	7,377	7,242	7,491	8,204	8,453	8,921
Michigan	780	694	647	725	744	762	796	749	776	768	792	887	884
Missouri and Iowa	4,513	4,651	4,437	4,517	4,643	4,632	4,605	4,767	5,020	4,894	4,627	4,549	4,820
Montana and Colorado	481	453	439	467	546	489	459	450	403	452	528	558	602
New Jersey	398	408	456	514	503	426	525	389	480	236	242	273	181
New Mexico	695	726	715	796	731	721	673	750	789	728	714	883	947
Ohio	6,601	6,972	6,661	7,101	6,796	6,151	6,052	5,927	6,008	6,709	7,091	6,387	6,126
Oklahoma	27,453	27,303	26,635	27,484	27,791	28,324	28,772	28,318	28,953	28,013	27,472	27,384	27,706

See footnotes at end of table.

Stocks of crude petroleum[1] *in the United States in 1945, by location and months*—Continued

[Thousands of barrels]

Classification	Jan. 1	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Pipe-line and tank-farm stocks—Continued.													
Pennsylvania, New York, and West Virginia	4, 310	4, 222	4, 139	4, 080	4, 033	4, 159	4, 191	4, 059	3, 788	3, 834	3, 675	2, 424	2, 262
Texas	68, 279	69, 217	69, 878	68, 885	68, 723	67, 790	65, 191	63, 976	62, 559	64, 822	69, 041	66, 113	65, 811
Wyoming and Utah	3, 822	3, 357	3, 662	3, 425	3, 403	3, 767	3, 463	3, 523	3, 753	3, 605	3, 383	3, 804	3, 943
Total pipe line and tank farm	158, 181	157, 808	157, 449	157, 755	156, 955	155, 557	151, 909	149, 247	147, 807	150, 984	154, 988	151, 753	153, 957
Producers' stock	14, 105	14, 309	14, 163	14, 329	14, 520	14, 422	14, 519	14, 338	14, 361	14, 866	14, 485	14, 407	14, 530
Total United States:													
1945 [3]	[2] 220, 663	221, 737	220, 221	223, 988	224, 229	223, 151	218, 218	216, 638	215, 135	220, 319	221, 246	218, 916	218, 763
1944 [3]	242, 132	241, 245	241, 718	236, 220	234, 694	235, 176	229, 631	223, 503	223, 901	222, 868	223, 500	222, 759	220, 862

[1] Excludes stocks of California heavy crude.
[2] New basis to compare with subsequent months; a transfer of 199,000 barrels of California condensate from crude-oil stocks.
[3] Final figures.

CONSUMPTION AND DISTRIBUTION

Runs to stills.—Total crude runs to stills amounted to 1,720 million barrels in 1945, a gain of 54 million barrels compared with 1944. Runs of foreign crude amounted to 74 million barrels, and runs of domestic crude were 1,646 million. The principal changes in refinery operations, by districts, in 1945 were gains of 19 million barrels in crude runs in California, 17 million in the East Coast district, 15 million in the Louisiana Gulf Coast district, 6 million in the Oklahoma-Kansas district, and 5 million in the Rocky Mountain district. The principal decreases in crude runs were 6 million barrels in the Texas Gulf Coast district and 3 million in the Indiana-Illinois district.

Distribution.—The total demand for domestic crude petroleum rose from 1,701 million barrels in 1944 to a new record of 1,715 million barrels in 1945—a gain of 14 million barrels, or less than 1 percent. The larger demand was met by an increase of 33 million barrels in crude production and a withdrawal of only 4 million barrels from stocks of domestic crude oil compared with a reduction in such stocks of 24 million barrels in 1944. The supply of domestic crude petroleum was supplemented by an increase in the imports of foreign crude oil from 45 million barrels in 1944 to 74 million in 1945. Imports of refined oils were 8 million barrels less than in 1944, and total stocks of refined oils were reduced by 10 million barrels during the year compared with a gain of almost 17 million barrels in 1944.

Receipts of domestic and foreign crude petroleum at United States refineries totaled 1,724 million barrels in 1945 compared with 1,669 million in 1944. In 1945 receipts of foreign crude petroleum were 74 million barrels, or 4.3 percent of the total; interstate receipts of domestic crude were 627 million, or 36.4 percent of the total; and intrastate receipts were 1,023 million, or 59.3 percent of the total.

Refinery receipts of crude in 1945, by methods of transportation, indicated that 79.4 percent of the total was delivered by pipe lines, compared with 83.3 percent in 1944; that 4.3 percent was delivered by tank car and truck, compared with 6.8 percent in 1944; and that 16.3 percent was delivered by boat, compared with 9.9 percent in 1944. These figures reflect the increase in the tanker movement from Gulf ports to East Coast refineries in the latter half of 1945, the increase in receipts of foreign crude by boat, and the reduction in war emergency movements by tank car and pipe line.

The principal changes in the market demand for crude petroleum by States of origin (computed from production and changes in crude stocks by origin) in 1945 compared with 1944 were gains of about 12 million barrels for Texas, 9 million for Oklahoma, and 7 million for California. The largest decreases were 4 million barrels for Illinois and 3 million for Kansas. Thirteen States had a market demand exceeding 10 million barrels in 1945 and contributed over 98 percent of the total supply.

The demand for Texas crude oil rose from 753 million barrels in 1944 to 765 million in 1945. The record production of 756 million barrels was supplemented by a withdrawal of over 9 million barrels from stocks of Texas origin. The relative contribution of Texas to the national demand rose from 44.2 percent in 1944 to 44.6 percent in 1945.

Runs to stills of crude petroleum in the United States in 1945, by districts and months [1]

[Thousands of barrels]

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
East Coast:													
Domestic	18, 326	16, 198	16, 989	16, 975	17, 532	16, 077	17, 686	17, 326	15, 037	14, 625	16, 844	16, 380	199, 995
Foreign	4, 598	3, 816	5, 460	5, 298	5, 492	6, 078	6, 851	7, 031	6, 378	8, 235	7, 457	6, 978	73, 672
Total East Coast	22, 924	20, 014	22, 449	22, 273	23, 024	22, 155	24, 537	24, 357	21, 415	22, 860	24, 301	23, 358	273, 667
Appalachian	4, 932	4, 439	4, 882	4, 870	5, 000	4, 821	4, 775	5, 014	3, 991	4, 013	4, 693	4, 769	56, 199
Indiana, Illinois, Kentucky, etc	23, 606	22, 637	23, 371	23, 440	24, 974	23, 080	25, 285	24, 572	19, 494	20, 798	22, 384	22, 212	275, 853
Oklahoma, Kansas, Missouri, etc	11, 976	10, 664	11, 672	11, 278	12, 393	11, 943	12, 158	12, 359	11, 685	11, 060	10, 390	11. 598	139, 176
Texas Inland	7, 265	6, 950	6, 917	7, 247	7, 819	7, 298	7, 526	7, 758	6, 805	6, 728	6, 163	6, 034	84, 510
Texas Gulf Coast:													
Domestic	34. 716	33, 116	35, 633	34, 732	35, 595	36, 524	36, 747	35, 370	25, 029	26, 769	33, 770	35, 416	403, 417
Foreign													
Total Texas Gulf Coast	34, 716	33, 116	35, 633	34, 732	35, 595	36, 524	36, 747	35, 370	25, 029	26, 769	33, 770	35, 416	403, 417
Louisiana Gulf Coast:													
Domestic	7, 567	7. 321	8, 399	6, 797	8, 034	8, 315	8, 402	8, 307	8, 735	9, 531	8, 738	9, 163	99, 309
Foreign													
Total Louisiana Gulf Coast	7, 567	7, 321	8, 399	6, 797	8, 034	8, 315	8, 402	8, 307	8, 735	9, 531	8, 738	9, 163	99, 309
Arkansas-Louisiana Inland	2, 423	2, 277	2, 293	2, 468	2, 474	2, 596	2, 578	2, 548	2, 445	2, 279	1, 803	1, 753	27, 937
Rocky Mountain	4, 006	3, 395	4, 078	3, 648	3, 826	4, 338	4. 273	4, 009	3, 652	3, 737	3, 303	3. 679	45, 944
California	25, 656	24, 069	26, 591	26, 468	29, 156	28, 612	28, 759	28, 477	24, 985	23, 792	23, 160	23, 797	313. 522
Total domestic	140, 473	131, 066	140, 825	137, 923	146, 803	143, 604	148, 189	145, 740	121, 858	123 332	131, 248	134, 801	1, 645, 862
Total foreign	4, 598	3, 816	5, 460	5, 298	5, 492	6, 078	6, 851	7, 031	6, 378	8, 235	7, 457	6, 978	73, 672
Total United States	145, 071	134, 882	146, 285	143, 221	152, 295	149, 682	155, 040	152. 771	128, 236	131. 567	138, 705	141, 779	1, 719, 534
Daily average	4, 680	4, 817	4, 719	4, 774	4, 913	4, 989	5, 001	4, 928	4, 275	4, 244	4, 624	4, 574	4, 711

[1] Subject to revision.

Approximately 56 percent of Texas crude was delivered to refineries within the State, and the remainder represented shipments to other States and exports. The largest interstate shipments were to refineries in the East Coast and Indiana-Illinois districts.

Demand for crude petroleum in the United States, 1942–45, by States of origin

[Thousands of barrels]

State	1942		1943		1944		1945 [1]	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
Alabama					33	0.1	151	0.4
Arkansas	26,902	73.7	27,143	74.4	29,226	79.9	29,272	80.2
California	250,479	686.2	288,363	790.0	322,473	881.1	329,473	902.7
Colorado	2,191	6.0	2,431	6.7	3,092	8.4	4,738	13.0
Illinois	115,417	316.2	78,396	214.8	77,307	211.2	73,023	200.1
Indiana	6,638	18.2	5,340	14.6	5,027	13.7	4,955	13.6
Kansas	98,281	269.3	105,715	289.7	98,134	268.1	95,191	260.8
Kentucky	4,687	12.8	7,775	21.3	9,598	26.2	10,247	28.1
Louisiana	116,394	318.9	121,085	331.7	130,819	357.4	129,545	354.9
Michigan	22,318	61.2	20,699	56.7	18,573	50.7	17,202	47.1
Mississippi	29,646	81.2	19,638	53.8	16,261	44.4	17,527	48.0
Montana	8,824	24.2	7,634	20.9	8,862	24.2	8,218	22.5
Nebraska	1,234	3.4	613	1.7	427	1.2	316	.9
New Mexico	32,819	89.9	37,599	103.0	40,062	109.5	37,908	103.8
New York	5,364	14.7	5,138	14.1	4,726	12.9	4,666	12.8
Ohio	3,552	9.7	3,260	8.9	3,020	8.2	2,819	7.7
Oklahoma	153,413	420.3	130,384	357.2	125,533	343.0	134,055	367.3
Pennsylvania	18,311	50.2	16,048	44.0	14,382	39.3	12,487	34.2
Texas	461,425	1,264.2	583,113	1,597.6	752,849	2,057.0	764,887	2,095.6
West Virginia	3,843	10.5	3,591	9.8	3,101	8.5	2,930	8.0
Wyoming	34,401	94.3	36,690	100.5	37,901	103.6	35,387	96.9
Other States	45	.1	48	.1	55	.2	101	.3
Total United States	1,396,184	3,825.2	1,500,703	4,111.5	1,701,461	4,648.8	1,715,098	4,698.9

[1] Subject to revision.

California ranked second as a source of crude supply in the United States and supplied 18.9 percent of the total market demand for domestic crude oil in 1944 and 19.2 percent in 1945. The demand for California crude oil amounted to over 322 million barrels in 1944 and exceeded 329 million in 1945. Production was supplemented by a withdrawal of 3 million barrels from stocks of California origin in 1945. About 308 million barrels of California oil were delivered to refineries within the State in 1945, 4 million barrels were exported to Canada, and 17 million barrels represented crude used direct for fuel and losses.

The demand for Oklahoma crude oil amounted to 134 million barrels in 1945 compared with over 125 million in 1944. Production rose from almost 125 million barrels in 1924 to 138 million in 1945, but about 4 million barrels were added to storage in 1945. This increase in production and demand gave Oklahoma third place as a source of national oil supply in 1945. About 57 million barrels of Oklahoma crude were delivered to refineries within the State in 1945. The largest outside market is in the Indiana-Illinois refinery district, with Kansas and the Appalachian refineries as the largest secondary markets.

Louisiana was the fourth largest source of domestic crude-oil supply in 1945. Production approximated 131 million barrels, about 1 million barrels were added to storage, and demand was almost 130 million barrels or 1 million barrels less than in 1944. Of the total deliveries to refineries in the United States, about 57 percent were intrastate, and the largest interstate shipments went to Texas.

Daily average demand for domestic crude petroleum in the United States in 1945, by States of origin and by months [1]

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
Alabama	0.1	0.2	0.2	0.5	0.4	0.8	0.4	0.1	0.4	0.3	1.4	0.3	0.4
Arkansas	86.1	84.8	81.7	82.8	77.7	78.1	84.5	72.1	88.4	76.4	72.3	77.7	80.2
California	889.8	908.4	901.6	919.7	986.1	986.0	961.4	948.1	871.9	821.9	817.8	810.3	902.7
Colorado	9.8	9.7	9.6	7.8	9.1	11.7	14.4	12.9	13.4	21.1	17.2	18.7	13.0
Illinois	202.0	212.2	209.1	209.9	226.9	204.7	214.9	228.3	138.2	163.8	216.8	174.1	200.1
Indiana	15.6	15.6	13.6	10.3	13.7	14.1	15.2	13.7	12.1	14.1	11.2	13.5	13.6
Kansas	257.9	274.8	256.5	254.7	289.3	267.5	260.1	258.8	264.1	234.6	262.7	250.1	260.8
Kentucky	27.7	34.1	21.2	32.0	27.7	27.1	28.2	28.3	26.4	29.3	31.2	24.6	28.1
Louisiana	293.9	377.1	352.1	346.7	327.9	375.4	386.5	376.3	336.3	336.0	381.8	371.9	354.9
Michigan	50.0	49.9	46.3	46.7	47.7	46.1	49.9	47.3	43.9	47.8	45.7	44.4	47.1
Mississippi	40.4	49.3	46.7	54.6	61.6	53.9	34.6	56.8	42.1	24.3	55.3	57.2	48.0
Montana	22.2	24.7	22.3	17.4	26.4	24.1	19.6	29.8	19.3	19.3	23.1	21.9	22.5
Nebraska	.6	1.5	.7	.9	.9	.7	1.1	.8	.7	1.0	.8	.7	.9
New Mexico	101.6	104.5	102.5	118.2	101.8	112.2	119.7	95.4	94.5	91.6	110.1	94.9	103.8
New York	12.1	11.8	12.4	12.7	12.2	14.6	10.8	15.3	12.8	11.6	14.9	12.2	12.8
Ohio	7.5	2.7	8.5	11.8	6.6	6.7	9.1	6.3	9.1	7.8	8.3	7.9	7.7
Oklahoma	376.0	358.9	358.4	360.2	357.4	369.7	381.7	393.4	343.7	397.0	339.1	369.1	367.3
Pennsylvania	32.3	33.3	33.9	35.7	34.3	35.5	35.3	36.4	34.5	30.9	35.0	33.4	34.2
Texas	2,151.4	2,174.7	2,109.6	2,160.3	2,244.8	2,248.8	2,229.4	2,204.5	1,781.5	1,789.6	2,045.7	2,009.6	2,095.6
West Virginia	7.1	6.9	8.5	8.1	7.8	8.7	9.8	6.6	7.1	8.4	9.3	8.0	8.0
Wyoming	111.5	86.2	113.1	101.3	93.0	116.8	106.8	93.1	92.4	86.7	79.3	82.4	96.9
Other States [2]	.2	.3	.4	.4	.2	.2	.3	.3	.3	.3	.3	.2	.3
Total United States	4,695.8	4,821.6	4,708.9	4,792.7	4,953.5	5,003.4	4,973.7	4,924.6	4,233.1	4,213.8	4,579.3	4,492.1	4,698.0

[1] Subject to revision.
[2] Florida, Missouri, Tennessee, and Virginia.

Demand for domestic crude petroleum in the United States, 1944–45, by States of origin and by months

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1944													
Alabama	----	----	----	1	----	3	2	1	5	10	5	6	33
Arkansas	2,517	2,300	2,528	2,370	2,569	2,492	2,348	2,721	2,345	2,379	2,312	2,345	29,226
California	27,376	25,507	27,137	26,631	26,176	26,944	26,655	26,235	26,091	27,784	27,592	28,345	322,473
Colorado	244	233	294	253	211	114	314	281	303	303	250	292	3,092
Illinois	6,285	5,360	6,466	6,500	6,651	6,555	6,455	6,226	6,150	7,161	7,190	6,308	77,307
Indiana	418	419	447	456	448	361	428	451	343	443	324	489	5,027
Kansas	8,340	7,592	8,237	7,971	7,870	8,579	8,186	8,675	8,037	8,229	8,144	8,274	98,134
Kentucky	778	790	572	616	713	854	822	942	858	950	792	911	9,598
Louisiana	10,517	11,238	11,567	10,331	11,180	11,364	10,970	11,084	11,430	10,734	9,797	10,607	130,819
Michigan	1,810	1,502	1,635	1,500	1,620	1,569	1,545	1,445	1,588	1,491	1,434	1,434	18,573
Mississippi	1,375	1,402	1,161	1,162	1,255	1,340	1,479	1,244	1,342	1,516	1,387	1,598	16,261
Montana	750	785	749	525	709	886	671	825	783	592	765	822	8,862
Nebraska	52	32	39	39	28	22	44	43	34	32	29	33	427
New Mexico	3,496	3,579	3,445	3,766	3,737	3,151	3,394	3,088	3,139	3,115	2,920	3,232	40,062
New York	398	376	399	389	413	395	385	423	391	386	387	384	4,726
Ohio	293	183	323	252	172	121	221	235	314	125	345	436	3,020
Oklahoma	10,563	9,596	10,403	9,564	11,013	9,748	10,440	10,582	11,049	11,639	10,183	10,753	125,533
Pennsylvania	1,244	1,137	1,209	1,201	1,209	1,220	1,267	1,265	1,217	1,192	1,146	1,075	14,382
Texas	56,456	54,017	61,167	59,667	62,329	63,597	67,649	66,083	64,513	65,643	64,641	67,087	752,849
West Virginia	293	234	289	247	221	235	334	279	206	246	296	221	3,101
Wyoming	3,639	2,839	3,381	3,032	2,845	3,166	3,339	3,160	3,545	3,285	2,598	3,072	37,901
Other States	5	4	5	4	5	4	5	5	5	5	5	3	[1] 55
Total United States	136,849	129,125	141,453	136,477	141,374	142,720	146,953	145,293	143,688	147,260	142,542	147,727	1,701,461
1945 [2]													
Alabama	4	5	5	16	11	24	12	2	12	9	43	8	151
Arkansas	2,669	2,375	2,532	2,485	2,410	2,344	2,619	2,237	2,653	2,369	2,169	2,410	29,272
California	27,584	25,436	27,948	27,591	30,568	29,581	29,805	29,391	26,159	25,479	24,533	25,398	329,473
Colorado	303	272	298	233	282	352	446	400	401	655	517	579	4,738
Illinois	6,262	5,942	6,483	6,297	7,033	6,141	6,662	7,078	4,145	5,078	6,506	5,396	73,023
Indiana	484	436	421	309	425	425	472	425	364	438	336	420	4,955
Kansas	7,995	7,695	7,951	7,640	8,967	8,026	8,064	8,023	7,923	7,273	7,882	7,752	95,191
Kentucky	857	955	657	960	860	813	873	876	790	907	935	754	10,247
Louisiana	9,110	10,560	10,915	10,397	10,165	11,262	11,982	11,666	10,088	10,416	11,454	11,530	129,545
Michigan	1,550	1,397	1,435	1,403	1,478	1,382	1,548	1,465	1,316	1,483	1,370	1,375	17,202
Mississippi	1,251	1,379	1,449	1,638	1,910	1,615	1,074	1,760	1,263	754	1,660	1,774	17,527
Montana	687	690	692	523	819	723	608	925	580	598	693	680	8,218
Nebraska	19	43	21	26	29	21	33	26	22	31	24	21	316

See footnotes at end of table.

Demand for domestic crude petroleum in the United States, 1944–45, by States origin and months—Continued

[Thousands of barrels]

State	January	February	March	April	May	June	July	August	September	October	November	December	Year
1945 [2]—Continued													
New Mexico	3, 150	2, 926	3, 176	3, 548	3, 155	3, 367	3, 710	2, 957	2, 834	2, 840	3, 303	2, 942	37, 908
New York	374	330	384	381	378	436	336	474	386	361	447	379	4, 666
Ohio	232	74	265	355	205	200	282	196	274	240	250	246	2, 819
Oklahoma	11, 657	10, 049	11, 111	10, 806	11, 080	11, 090	11, 832	12, 197	10, 311	12, 308	10, 172	11, 442	134, 055
Pennsylvania	1, 002	933	1, 052	1, 071	1, 064	1, 064	1, 094	1, 129	1, 034	958	1, 051	1, 035	12, 487
Texas	66, 693	60, 892	65, 399	64, 810	69, 590	67, 464	69, 112	68, 340	53, 445	55, 476	61, 370	62, 296	764, 887
West Virginia	221	193	264	243	241	261	304	205	212	259	279	248	2, 930
Wyoming	3, 457	2, 414	3, 506	3, 040	2, 884	3, 504	3, 310	2, 884	2, 771	2, 686	2, 378	2, 553	35, 387
Other States	8	10	11	10	5	6	8	8	10	10	8	7	[3] 101
Total United States	145, 569	135, 006	145, 975	143, 782	153, 559	150, 101	154, 186	152, 664	126, 993	130, 628	137, 380	139, 255	1, 175, 098

[1] Missouri (43), Tennessee (9), and Virginia (3).
[2] Subject to revision.
[3] Florida (42), Missouri (47), Tennessee (8), and Virginia (4).

Distribution of crude petroleum in the United States in 1945, by States [1]

[Thousands of barrels]

State	Production	Refinery receipts of domestic crude, by origin							Runs to stills	Transfers to fuel
		Illinois	Kansas	Louisiana	New Mexico	Oklahoma	Texas	Other		
Alabama	181									3
Arkansas	28,613							15,025	14,857	162
California	326,482						5,021	309,295	[2] 313,522	16,042
Colorado	4,959							4,424	4,320	45
Georgia, Delaware, South Carolina, and Virginia				13				842	3,249	
Illinois	75,210	23,299	15,118	1,384	4,350	23,167	26,531	2,960	[3] 96,587	559
Indiana	4,868	2,017	20,957	489		14,524	45,950	730	84,797	36
Kansas and Nebraska	96,302		44,354			9,114	7,286	930	61,076	321
Kentucky and Tennessee	10,333	4,608		641			1,711	11,833	18,916	36
Louisiana:										
Gulf	106,977			66,849			27,351	5,574	99,309	1,122
Inland	23,589			2,894			4,016	5,788	11,995	296
Maryland				2,297			11,112	1,697	20,362	
Massachusetts and Rhode Island				486			12,149	1,351	19,411	
Michigan	17,259	2,130				2,722	5,988	16,430	27,273	284
Mississippi	18,775								1,085	255
Missouri	45		790			1,322	7,519		9,662	43
Montana	8,397							10,989	10,802	12
New Jersey				3,232	522	2,244	64,623	4,075	95,074	
New Mexico	37,281				3,910		560		4,459	198
New York:										
East							9,271	337	11,787	
West	4,648	4,552	918			4,660		3,720	13,899	
Ohio:										
East	2,828	13,505				2,663	129	4,133	20,454	145
West		18,171	343	4,206		11,643	13,798	627	48,280	
Oklahoma	138,036		5,899			57,005	6,307		68,438	804
Pennsylvania:										
East				5,446	550	3,118	76,846		123,784	
West	12,515	854		770		1,040	1,917	12,657	17,318	5
Texas:										
Gulf	253,455			32,025	14,702	3,112	353,982	95	403,417	1,115
Inland	502,078				1,512	487	82,763		84,510	1,761
Utah								5,802	5,780	
West Virginia	2,879	17		513		867	301	2,834	4,528	
Wyoming	35,359							20,501	[4] 20,583	530
Other	34									
Total United States	1,711,103	69,153	88,379	121,245	25,546	137,688	765,131	442,649	1,719,534	23,774

[1] Subject to revision.
[2] Includes Washington.
[3] Includes Minnesota and Wisconsin.
[4] Includes Idaho.

The demand for Kansas crude oil declined from 98 million barrels in 1944 to 95 million in 1945. Almost 1 million barrels were added to stocks of Kansas origin during the year. Shipments to refineries in Kansas amounted to over 44 million barrels, and the major outside market was in the Indiana-Illinois refinery district.

Illinois ranked sixth in the national supply of domestic crude oil. The demand for crude of Illinois origin declined from 77 million barrels in 1944 to 73 million in 1945. Production declined from over 77 million barrels in 1944 to 75 million in 1945, and about 2 million barrels were added to storage during the year. About 23 million barrels of Illinois oil were delivered to refineries within the State. The largest outside market for Illinois oil was in Ohio, and there was a substantial export to Canada.

The demand for New Mexico crude declined from 40 million barrels in 1944 to 38 million in 1945. The major part of New Mexico crude was shipped to refineries in Texas. The demand for Wyoming crude declined from 38 million barrels in 1944 to about 35 million in 1935. About 21 million barrels were shipped to refineries within the State, 12 million barrels were sent to other Mountain States, and about 2 million barrels were marketed in Illinois, Indiana, and Missouri. The increase in the demand for Colorado crude—from 3 million barrels in 1944 to almost 5 million in 1945—partly offset the decline in the demand for Wyoming crude oil.

The demand for Arkansas crude oil amounted to 29 million barrels in 1945, with virtually no change compared with 1944. About 15 million barrels were delivered to refineries in the State, and the major part of the remainder went to refineries in Louisiana.

The demand for Mississippi crude oil gained over 1 million barrels in 1945, while the demand for Michigan crude declined over 1 million barrels, and the supply of Pennsylvania crude was almost 2 million barrels less than in 1944.

Receipts of crude petroleum at refineries in the United States, 1941–45, by methods of transportation

[Millions of barrels]

Method of transportation	1941	1942	1943	1944	1945 [1]
By boat:					
Intrastate	69.1	45.2	54.4	63.2	94.1
Interstate	199.9	74.3	35.2	57.1	113.3
Foreign	50.6	12.2	13.8	44.8	74.0
Total by boat	319.6	131.7	103.4	165.1	281.4
By pipe lines:					
Intrastate	728.9	731.2	788.8	909.6	913.7
Interstate	313.1	330.5	390.1	480.8	454.5
Total by pipe lines	1,042.0	1,061.7	1,178.9	1,390.4	1,368.2
By tank car and truck:					
Intrastate	17.2	18.0	15.7	16.5	15.2
Interstate	31.3	116.3	138.2	96.5	59.1
Total by tank car and truck	48.5	134.3	153.9	113.0	74.3
Grand total	1,410.1	1,327.7	1,436.2	1,668.5	1,723.9

[1] Subject to revision.

PRICES AND VALUE

Since there were no general increases in posted crude prices in 1945, the only important change in the value of crude oil at the well resulted from the stripper-well subsidy plan. The subsidy plan, effective August 1, 1944, was in operation for the full year 1945, compared with 5 months in 1944. This plan provided for Federal payments of 35 cents per barrel for fields with average production of less than 5 barrels daily per well; of 25 cents per barrel for fields averaging 5 barrels and less than 7 barrels daily per well; and of 20 cents per barrel for fields averaging 7 barrels and less than 9 barrels daily per well. The plan also authorized payment of 75 cents per barrel for all Pennsylvania Grade oil produced in Pennsylvania, New York, West Virginia, and Ohio. A number of other stripper pools were added to the list in 1945 because of high production costs.

These subsidy payments are supplemental to posted crude prices and are included in the Bureau of Mines figures for average value of crude oil at the well.

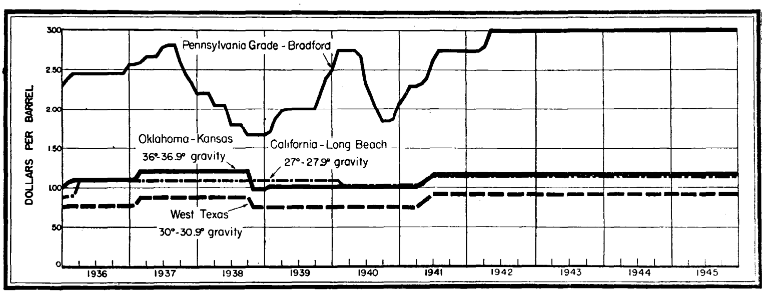

FIGURE 5.—Posted prices of selected grades of crude petroleum in the United States, 1936–45, by months.

Complete data on values in 1945 are not yet available, but the preliminary estimate for all crude produced in 1945 is $1.22 per barrel, compared with the average of $1.21 per barrel in 1944. This increase of 1 cent per barrel is slightly less than would be expected from subsidy payments for 12 months in 1945, compared with the increase from subsidy payments for only 5 months in 1944, but the increased production of lower-value crudes in 1945 tended to offset the effects of subsidy payments upon the national average.

Value of crude petroleum at wells in the United States, 1943–44, by States [1]

State	1943		1944	
	Total (thousands of dollars)	Average per barrel	Total (thousands of dollars)	Average per barrel
Arkansas	27, 320	$0.99	30, 890	$1.05
California	298, 400	1.05	330, 800	1.06
Colorado	2, 620	1.13	3, 530	1.15
Illinois	112, 700	1.37	107, 370	1.39
Indiana	7, 130	1.35	7, 080	1.38
Kansas	127, 410	1.20	120, 290	1.22
Kentucky	10, 800	1.37	13, 640	1.42
Louisiana:				
Gulf Coast	117, 360	1.22	129, 500	1.23
Northern	33, 150	1.21	29, 100	1.21
Total Louisiana	150, 510	1.22	158, 600	1.22
Michigan	29, 280	1.41	26, 410	1.43
Mississippi	18, 430	.98	16, 730	1.02
Montana	9, 500	1.20	10, 700	1.24
Nebraska	570	.90	460	1.10
New Mexico	38, 900	1.00	39, 600	1.00
New York	15, 230	3.01	15, 640	3.33
Ohio	6, 810	2.05	6, 560	2.23
Oklahoma	146, 550	1.19	153, 290	1.23
Pennsylvania	46, 960	2.98	46, 400	3.29
Texas:				
Gulf Coast	262, 170	1.31	341, 590	1.31
East Texas proper	162, 480	1.25	168, 990	1.25
West Texas	98, 230	.99	160, 210	1.00
Rest of State	194, 720	1.18	231, 870	1.22
Total Texas	717, 600	1.21	902, 660	1.21
West Virginia	8, 670	2.59	8, 910	2.90
Wyoming	33, 570	.98	33, 290	1.00
Other States [2]	60	1.15	110	.98
Total United States	1, 809, 020	1.20	2, 032, 960	1.21

[1] Figures for 1945 not yet available.
[2] 1943: Florida, Missouri, Tennessee, and Virginia; 1944: Alabama, Florida, Missouri, Tennessee, and Virginia.

Posted price per barrel of petroleum at wells in the United States in 1945, by grades, with dates of change

Date	Pennsylvania Grade		Corning Grade in Buckeye Pipe Line Co.[2]	Western Kentucky [3]	Illinois Basin [4]	Midland, Mich.[5]	Oklahoma-Kansas [6]	
	Bradford and Allegany districts [1]	In Southwest Pennsylvania pipe lines [2]					34°–34.9°	36°–36.9°
Jan. 1	$3.00	$2.65	$1.31	$1.37	$1.37	$1.44	$1.13	$1.17
	3.00	2.65	1.31	1.37	1.37	1.44	1.13	1.17

Posted price per barrel of petroleum at wells in the United States in 1945, by grades, with dates of change—Continued

Date	Panhandle Texas (Carson, Gray, Hutchinson, and Wheeler Counties), 35°-35.9° [7]	West Texas, 30°-30.9° [7]	Lea County, N. Mex., 30°-30.9 [7]	South Texas, Duval-Mirando, 22°-22.9° [7]	East Texas [7]	Gulf Coast: Conroe, Tex. [8]	Gulf Coast: Texas 30°-30.9° [8]	Gulf Coast: Texas 20°-20.9° [8]	Gulf Coast: Louisiana 30°-30.9° [9]
Jan. 1	$1.12	$0.92	$0.92	$1.09	$1.25	$1.43	$1.28	$1.08	$1.10
	1.12	.92	.92	1.09	1.25	1.43	1.28	1.08	1.10

Date	Rodessa, La., 36°-36.9° [9]	Smackover, Ark. [10]	Salt Creek, Wyo., 36°-36.9° [11]	Lance Creek, Wyo., 40° and above [4]	California [12]: Kettleman, 37°-37.9°	California [12]: Long Beach, 27°-27.9°	California [12]: Midway-Sunset, 19°-19.9°	California [12]: Santa Fe Springs, 33°-33.9°
Jan. 1	$1.12	$0.98	$1.17	$1.25	$1.29	$1.15	$0.98	$1.26
	1.12	.98	1.17	1.25	1.29	1.15	.98	1.26

1 The Tide Water Associated Oil Co.
2 The South Penn Oil Co.
3 Sohio Corp.
4 The Ohio Oil Co.
5 The Pure Oil Co.
6 Standard Oil Co. (Indiana).
7 Humble Oil & Refining Co.
8 The Texas Co.
9 Standard Oil Co. of New Jersey.
10 Arkansas Fuel Oil Co.
11 Stanolind Oil & Gas Co.
12 Standard Oil Co. of California.

REFINED PRODUCTS

GENERAL REVIEW

The demand for refined products in 1945 reflects the shift from a peak wartime basis to a period of readjustment involving the removal of wartime controls, the termination of lend-lease exports, a rapid decline in military purchases with a draft on surplus stocks in military custody, and a substantial increase in civilian consumption. The interpretation of these trends was obscured by the shut-down of a substantial part of refinery capacity in the last half of September and the first half of October. Estimates of probable demand for the early part of 1946 proved to be materially below actual requirements and necessitated a sharp upward revision of forecasts for demand during 1946.

The total demand for all oils rose from 1,879 million barrels in 1944, to 1,952 million in 1945—a gain of 73 million barrels or about 4 percent. Exports of refined products declined from 173 million barrels in 1944 to 151 million in 1945. Domestic demand for all oils, including military consumption in the United States and shipments to our armed forces abroad, rose from 1,671 million barrels in 1944 to 1,768 million in 1945. The domestic demand for motor fuel showed a gain of 64 million barrels, the demand for distillate fuel oils increased about 16 million barrels, and the domestic demand for residual fuel oil gained 11 million barrels compared with 1944.

Runs to stills and production at refineries in the United States of the various refined products, 1941–45

[Thousands of barrels, except as otherwise indicated]

Product	1941	1942	1943	1944	1945 [1]
Input:					
Crude petroleum:					
Domestic	1,358,246	1,319,507	1,417,559	1,622,514	1,645,862
Foreign	50,946	14,596	12,179	43,170	73,672
Total crude petroleum	1,409,192	1,334,103	1,429,738	1,665,684	1,719,534
Natural gasoline	47,825	56,595	61,198	67,207	70,324
Total input	1,457,017	1,390,698	1,490,936	1,732,891	1,789,858
Output:					
Gasoline	671,110	586,971	592,425	722,718	774,460
Kerosine	72,586	67,474	72,270	78,344	81,024
Distillate fuel oil	189,177	196,714	211,516	239,152	249,224
Residual fuel oil	342,367	358,901	417,306	461,455	469,492
Lubricating oil	39,539	38,626	38,679	41,106	41,867
Wax [2]	2,393	2,502	2,697	2,883	2,921
Coke [2]	8,244	6,692	6,942	9,017	10,115
Asphalt [2]	36,067	34,631	37,162	38,479	39,196
Still gas [2]	83,354	78,924	86,755	102,239	103,458
Wax ... thousands of pounds	670,040	700,560	755,160	807,240	817,880
Coke ... thousands of short tons	1,648.8	1,338.4	1,388.4	1,803.4	2,023.0
Asphalt ... do	6,557.6	6,296.5	6,756.7	6,996.1	7,126.6
Still gas ... millions of cubic feet	300,074	284,126	312,318	368,061	372,449
Road oil	9,149	8,039	2,295	1,556	2,686
Other finished products	6,266	8,117	9,660	18,436	19,080
Crude gasoline (net)	1,219	1,669	1,009	1,745	[3] 4,892
Other unfinished oils (net)	[3] 3,204	[3] 3,353	2,597	2,584	[3] 5,727
Shortage	[4] 1,250	4,791	9,623	13,177	6,954
Total output	1,457,017	1,390,698	1,490,936	1,732,891	1,789,858

[1] Subject to revision.
[2] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.
[3] Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.
[4] Negative quantity (overage).

Comparative analyses of statistics for the major refined products in the United States, 1941–45

[Thousands of barrels, except as otherwise indicated]

Product	1941	1942	1943	1944	1945 [1]
Motor fuel:					
Production	701,294	608,900	608,180	739,340	799,059
Imports	335	115	5,736	3,148	1,807
Exports	27,083	35,097	51,577	100,537	88,850
Stocks, end of period	90,596	75,404	69,505 [2] 68,405	77,874 [2] 78,073	93,682
Domestic demand	667,505	589,110	568,238	632,482	696,407
Kerosine:					
Production	72,586	67,474	72,270	78,344	81,024
Imports	191	418	375	147	----------
Exports	3,221	2,576	4,752	4,888	6,158
Stocks, end of period	14,515	10,064	9,359	11,150	10,421
Domestic demand	69,469	69,767	68,598	71,812	75,595
Distillate fuel oil:					
Production	189,177	196,714	211,516	239,152	249,224
Transfers	2,513	2,496	3,070	3,242	3,047
Imports	5,074	3,636	15,269	7,022	4,754
Exports	16,925	21,575	24,957	43,491	33,827
Stocks, end of period	49,330	44,940	41,728	38,333	35,778
Domestic demand	172,824	185,661	208,110	209,320	225,753

Comparative analyses of statistics for the major refined products in the United States, 1941–45—Continued

[Thousands of barrels, except as otherwise indicated]

Product	1941	1942	1943	1944	1945 [1]
Residual fuel oil:					
Production	342, 367	358, 901	417, 306	461, 455	469, 492
Transfers	12, 969	19, 283	24, 087	28, 515	20, 727
Imports	37, 369	18, 432	27, 210	36, 485	31, 557
Exports	14, 114	12, 095	14, 894	12, 536	11, 919
Stocks, end of period	82, 959	61, 783	48, 484	50, 383	37, 158
Domestic demand	383, 422	405, 697	467, 008	512, 020	523, 082
Lubricating oil:					
Production	39, 539	38, 626	38, 679	41, 106	41, 867
Imports					
Exports	9, 924	8, 272	8, 863	8, 709	6, 591
Stocks, end of period	8, 127	9, 424	7, 781	7, 815	7, 773
Domestic demand	30, 255	29, 057	31, 459	32, 363	35, 318
Wax (thousands of pounds):					
Production	670, 040	700, 560	755, 160	807, 240	817, 880
Imports	16, 542	9, 749	109		1, 798
Exports	213, 075	153, 519	172, 799	162, 236	158, 302
Stocks, end of period	74, 814	85, 400	82, 040	93, 800	82, 040
Domestic demand	523, 965	546, 204	585, 830	633, 244	673, 136
Coke (thousands of short tons):					
Production	1, 648. 8	1, 338. 4	1, 388. 4	1, 803. 4	2, 023. 0
Exports	279. 1	325. 3	314. 0	209. 0	210. 6
Stocks, end of period	228. 0	233. 8	258. 2	187. 2	158. 2
Domestic demand	1, 628. 7	1, 007. 3	1, 050. 0	1, 665. 4	1, 841. 4
Asphalt (thousands of short tons):					
Production	6, 557. 6	6, 296. 5	6, 756. 7	6, 996. 1	7, 126. 6
Imports	158. 3	121. 2	113. 0	126. 4	162. 9
Exports	274. 1	113. 8	98. 9	127. 1	224. 8
Stocks, end of period	604. 0	411. 0	563. 3	626. 2	692. 7
Domestic demand	6, 451. 8	6, 496. 9	6, 618. 5	6, 932. 5	6, 698. 2
Road oil:					
Production	9, 149	8, 039	2, 295	1, 556	2, 686
Stocks, end of period	793	348	193	189	370
Domestic demand	8, 980	8, 484	2, 450	1, 560	2, 505
Other finished products:					
Production	6, 266	8, 117	9, 660	18, 436	19, 080
Transfers of L. P. G. from natural gasoline	6, 281	7, 195	11, 589	16, 796	18, 383
Exports	660	657	841	893	1, 076
Stocks, end of period	489	597	734	965	1, 061
Domestic demand	11, 862	14, 547	20, 271	34, 108	36, 291
Unfinished gasoline:					
Rerun (net)	[3] 1, 219	[3] 1, 669	[3] 1, 009	[3] 1, 745	4, 892
Stocks	7, 685	9, 354	10, 363 [2] 11, 463	13, 208	8, 316
Other unfinished oils:					
Rerun (net)	3, 204	3, 353	[3] 2, 597	[3] 2, 584	5, 727
Transfers of cycle products	(4)	(4)	1, 574	1, 821	848
Imports	2, 637	366	366	9	258
Stocks	39, 524	36, 537	41, 074	45, 488	40, 867
Shortage	−1, 250	4, 791	9, 623	13, 177	6, 954

[1] Subject to revision.
[2] New basis—to compare with following year.
[3] Negative quantity; represents net excess of unfinished rerun over unfinished produced.
[4] Not available.

Imports of refined products amounted to about 9 million barrels less in 1945 than in 1944, with the largest decline in residual fuel oils.

Crude runs to stills rose from about 1,666 million barrels in 1944 to 1,720 million in 1945—a gain of 54 million barrels. On a daily average basis these runs amounted to 4,551,000 barrels in 1944 and 4,711,000 barrels in 1945—a gain of 3.5 percent.

Changes in the relative demand for products have been reflected in the refinery yields from crude oil. The total gasoline yield declined to a low of 37.1 percent in 1943, rose to 39.4 percent in 1944, and increased to 40.9 percent in 1945. The yield of distillate fuel oil remained fairly constant during the war years and amounted to 14.4 percent in 1944 and 14.5 percent in 1945. The yield of residual fuel oil reached a peak of 27.7 percent in 1944 and declined to 27.3 percent in 1945.

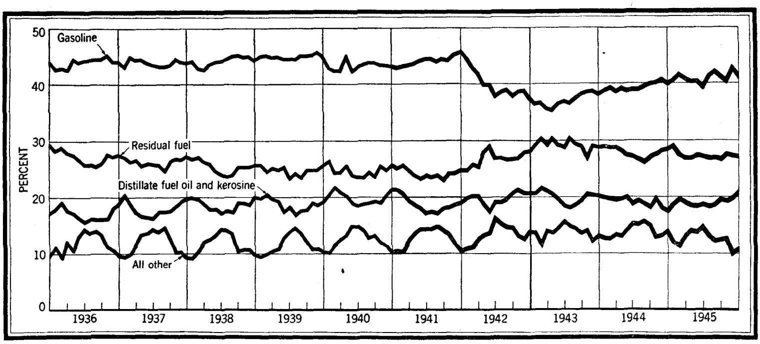

FIGURE 6.—Yields of principal products from crude oil run to stills in the United States, 1936–45, by months.

Summary of percentage yields of refined products in the United States, 1937–45

[Computed on total crude runs to stills]

Product	1937	1938	1939	1940	1941	1942	1943	1944	1945 [1]
Finished products:									
Gasoline.									
Cracked	22.6	23.2	23.9	22.7	24.4	22.3	22.0	23.2	23.3
Straight run	21.3	21.1	21.1	20.4	19.8	17.5	15.1	16.2	17.6
Total gasoline	43.9	44.3	45.0	43.1	44.2	39.8	37.1	39.4	40.9
Kerosine	5.5	5.5	5.5	5.7	5.2	5.1	5.0	4.7	4.7
Distillate fuel oil	12.4	13.0	13.1	14.2	13.4	14.7	14.8	14.4	14.5
Residual fuel oil	26.4	25.3	24.7	24.4	24.3	26.9	29.2	27.7	27.3
Lubricating oil	3.0	2.6	2.8	2.8	2.8	2.9	2.7	2.5	2.4
Wax	.2	.1	.1	.1	.2	.2	.2	.2	.2
Coke	.6	.7	.7	.6	.6	.5	.5	.5	.6
Asphalt	1.9	2.1	2.2	2.3	2.6	2.6	2.6	2.3	2.3
Road oil	.7	.6	.6	.6	.6	.6	.2	.1	.2
Still gas	5.4	5.7	5.5	5.5	5.9	5.9	6.1	6.1	6.0
Other	.2	.2	.2	.3	.4	.6	.7	1.1	1.1
Unfinished products:									
Gasoline	([2] [3])	[3] 1	([2] [3])	.1	.1	.1	([2])	.1	[3] .3
Other	[3] .7	[3] .4	[3] .9	[3] .3	[3] .2	[3] .3	.2	.1	[3] .3
Shortage	.5	.4	.5	.6	[3] .1	.4	.7	.8	.4
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Subject to revision. [2] Less than 0.1 percent.
[3] Negative percentage; represents excess percentage rerun over percentage produced.

Stocks of refined oils declined from 246 million barrels at the end of 1944 to 236 million at the end of 1945, compared with 294 million at the end of 1941. The principal changes in 1945 were an increase of 15.8 million barrels in stocks of finished gasoline, a decrease of 13.2 million in residual fuel-oil stocks, a decline of 2.5 million in stocks of distillate fuel oil, and a reduction of 4.9 million in stocks of unfinished gasoline. In view of actual demand in the first quarter of 1946, stocks of gasoline were relatively high, and stocks of fuel oils and kerosine were low, necessitating an abnormal readjustment of yields to meet requirements.

Stocks of refined products in the United States, 1944–45, by months

[Thousands of barrels, except as otherwise indicated]

Product	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
1944												
Gasoline	69, 390	72, 909	75, 275	76, 638	74, 519	70, 246	68, 921	66, 542	64. 914	65, 886	68, 107	73, 622
Kerosine	8, 257	7, 259	6, 567	6, 722	8, 117	9, 825	11, 799	13, 339	14, 648	14, 454	13, 771	11, 150
Distillate fuel oil	36, 890	33, 561	29, 926	30, 152	32, 484	35, 242	38, 335	40, 712	43, 687	47, 352	45, 584	38, 333
Residual fuel oil	46, 270	45, 070	45, 427	44, 137	44, 682	46. 649	50, 589	53, 506	57, 849	57, 420	55, 643	50, 383
Lubricating oil	8, 006	7, 942	8, 011	8, 068	7, 771	7, 590	7, 426	7, 169	7, 364	7, 452	7, 562	7, 815
Wax [1]	288	286	302	336	335	327	335	343	339	346	339	335
Coke [1]	897	828	864	832	707	636	648	579	580	686	808	936
Asphalt [1]	3, 472	3, 948	4, 374	4, 687	4, 892	4. 645	4, 046	3, 245	2, 723	2, 562	2, 939	3, 444
Wax .... thousands of pounds	80, 640	80, 080	84, 560	94, 080	93, 800	91, 560	93, 800	96, 040	94, 920	96, 880	94, 920	93, 800
Coke .... thousands of short tons	179. 4	165. 6	172. 8	166. 4	141. 4	127. 2	129. 6	115. 8	116. 0	137. 2	161. 6	187. 2
Asphalt .... do	631. 3	717. 9	795. 3	852. 2	889. 5	844. 6	735. 6	590. 0	495. 1	465. 8	534. 4	626. 2
Road oil	230	237	331	378	417	304	286	242	201	199	170	189
Other finished products	772	749	785	818	847	839	860	880	948	1, 137	952	965
Unfinished gasoline	11, 919	11, 843	11, 972	11, 735	12, 193	11, 738	11, 581	11, 924	12, 072	12, 388	12, 467	13, 208
Other unfinished oils	40, 733	40, 863	41, 300	42, 175	42, 562	44, 726	45, 911	46, 909	47, 689	45, 942	45, 222	45, 488
Total	227, 124	225, 495	225, 134	226, 678	229, 526	232, 767	240, 737	245, 390	253, 014	255, 824	253, 564	245, 868
1945												
Gasoline	78, 877	85, 473	85, 654	79, 653	77, 151	74, 089	74, 460	74, 270	65, 489	68, 039	78, 091	89, 360
Kerosine	8, 742	7, 150	6, 925	8, 252	8, 574	9, 599	11, 157	13, 894	13, 675	12, 708	12, 141	10, 421
Distillate fuel oil	31, 695	27, 210	26, 729	29, 148	29, 511	32, 440	36, 276	41, 245	45, 059	45, 479	44, 562	35, 778
Residual fuel oil	44, 347	39, 760	35, 451	34, 418	34, 333	35, 606	38, 341	42, 227	42, 822	42, 068	41, 322	37, 158
Lubricating oil	7, 796	7, 641	7, 423	7, 307	7, 026	6, 770	6, 321	6, 505	6, 840	7, 221	7, 595	7, 773
Wax [1]	316	308	312	303	290	255	281	295	301	301	297	293
Coke [1]	872	656	624	704	752	738	770	802	811	795	797	791
Asphalt [1]	4, 015	4, 445	4, 741	5, 001	5, 035	4, 594	4, 019	3, 257	2, 883	2, 767	3, 071	3, 810
Wax .... thousands of pounds	88, 480	86, 240	87, 360	84. 840	81, 200	71, 400	78, 680	82, 600	84, 280	84, 280	83, 160	82, 040
Coke .... thousands of short tons	174. 4	131. 2	124. 8	140. 8	150. 4	147. 6	154. 0	160. 4	162. 2	159. 0	159. 4	158. 2
Asphalt .... do	730. 0	808. 2	862. 0	909. 3	915. 5	835. 3	730. 7	592. 2	524. 2	503. 1	558. 4	692. 7
Road oil	237	248	326	438	595	394	361	348	357	330	342	370
Other finished products	969	999	1, 056	1, 051	978	1, 049	1, 025	997	1, 000	1, 003	1, 084	1, 061
Unfinished gasoline	12, 789	11, 984	11, 793	11, 151	11, 179	12, 039	11, 122	9, 733	9, 085	8, 766	8, 449	8, 316
Other unfinished oils	43, 970	42, 563	42, 256	43, 017	43, 140	43, 616	43, 257	42, 764	42, 821	43, 585	41, 526	40, 867
Total	234, 625	228, 437	223, 290	220, 443	218, 564	221, 189	227, 390	236, 337	231, 143	233, 062	239, 277	235, 998

[1] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton.

Runs to stills and production at refineries in the United States of the various refined products, 1944–45, by months

[Thousands of barrels, except as otherwise indicated]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1944													
Input:													
Crude petroleum	133,161	126,993	137,902	132,330	139,537	139,937	143,434	143,047	140,453	143,720	140,045	145,125	1,665,684
Natural gasoline	5,382	4,624	5,377	5,012	5,198	5,429	6,165	6,084	5,799	6,020	6,109	6,008	67,207
Total input	138,543	131,617	143,279	137,342	144,735	145,366	149,599	149,131	146,252	149,740	146,154	151,133	1,732,891
Output:													
Gasoline	56,957	54,369	58,430	56,689	59,060	59,898	61,975	62,508	61,909	63,631	63,183	64,109	722,718
Kerosine	7,071	6,413	6,960	6,489	6,710	6,246	6,277	6,358	6,339	6,515	6,505	6,461	78,344
Distillate fuel oil	19,344	18,454	19,863	19,604	21,215	20,028	21,316	20,593	19,110	21,697	18,870	19,058	230,152
Residual fuel oil	38,519	36,493	39,738	37,281	38,026	37,902	38,332	37,291	37,903	39,322	39,370	41,278	461,455
Lubricating oil	3,379	3,158	3,488	3,273	3,337	3,453	3,364	3,356	3,458	3,672	3,587	3,581	41,106
Wax [1]	254	235	285	273	234	216	227	229	222	241	227	240	2,883
Coke [1]	581	688	718	685	724	677	789	791	777	906	819	862	9,017
Asphalt [1]	2,326	2,190	2,505	2,505	3,294	3,799	3,914	4,401	4,127	3,727	3,045	2,646	38,479
Still gas [1]	7,799	7,521	8,135	7,976	8,713	8,768	9,204	9,178	8,685	8,864	8,558	8,838	102,239
Wax — thousands of pounds	71,120	65,800	79,800	76,440	65,520	60,480	63,560	64,120	62,160	67,480	63,560	67,200	807,240
Coke — thousands of short tons	116.2	137.6	143.6	137.0	144.8	135.4	157.8	158.2	155.4	181.2	163.8	172.4	1,803.4
Asphalt — do	422.9	398.2	455.4	455.5	598.9	690.7	711.6	800.2	750.4	677.6	553.6	481.1	6,996.1
Still gas — millions of cubic feet	28,076	27,076	29,286	28,714	31,367	31,565	33,134	33,041	31,266	31,910	30,809	31,817	368,061
Road oil	109	61	122	84	174	98	202	204	153	160	76	113	1,556
Other finished products	1,357	1,285	1,600	1,346	1,412	1,478	1,510	1,579	1,393	1,703	1,786	1,987	18,436
Unfinished gasoline (net)	456	[2] 76	129	[2] 237	458	[2] 455	[2] 157	343	148	316	79	741	1,745
Other unfinished oils (net)	[2] 517	[2] 20	275	719	248	1,994	1,019	822	648	[2] 1,881	[2] 850	127	2,584
Shortage	908	846	1,031	655	1,130	1,264	1,627	1,478	1,380	867	899	1,092	13,177
Total output	138,543	131,617	143,279	137,342	144,735	145,366	149,599	149,131	146,252	149,740	146,154	151,133	1,732,891

1945 [3]													
Input:													
Crude petroleum	145, 071	134, 882	146, 285	143, 221	152, 295	149, 682	155, 040	152, 771	128, 236	131, 567	138, 705	141, 779	1, 719, 534
Natural gasoline	6, 380	5, 457	6, 138	6, 077	6, 114	6, 065	6, 551	6, 236	5, 081	5, 483	5, 425	5, 317	70, 324
Total input	151, 451	140, 339	152, 423	149, 298	158, 409	155, 747	161, 591	159, 007	133, 317	137, 050	144, 130	147, 096	1, 789, 858
Output:													
Gasoline	64, 909	61, 445	65, 830	63, 807	67, 547	64, 972	70, 704	70, 328	57, 988	58, 542	64, 682	63, 706	774, 460
Kerosine	6, 614	6, 291	7, 056	6, 260	6, 445	6, 337	6, 520	7, 089	5, 858	6, 447	7, 564	8, 543	81, 024
Distillate fuel oil	20, 556	20, 267	20, 934	20, 443	21, 941	21, 891	22, 099	21, 740	19, 204	19, 009	19, 964	21, 176	249, 224
Residual fuel oil	41, 862	37, 141	39, 471	38, 660	41, 569	40, 527	41, 881	41, 200	34, 183	36, 452	37, 937	38, 609	469, 492
Lubricating oil	3, 504	3, 062	3, 589	3, 716	3, 882	3, 567	3, 645	3, 712	3, 128	3, 265	3, 485	3, 312	41, 867
Wax [1]	257	232	291	252	254	251	255	262	193	208	238	228	2, 921
Coke [1]	907	815	862	921	893	858	924	902	741	718	760	814	10, 115
Asphalt [1]	2, 592	2, 315	2, 569	2, 882	3, 471	3, 746	4, 346	4, 249	3, 646	3, 575	3, 104	2, 701	39, 196
Still gas [1]	9, 134	8, 397	9, 552	9, 241	9, 474	9, 482	9, 638	9, 069	7, 319	7, 006	7, 618	7, 528	103, 458
Wax thousands of pounds	71, 960	64, 960	81, 480	70, 560	71, 120	70, 280	71, 400	73, 360	54, 040	58, 240	66, 640	63, 840	817, 880
Coke thousands of short tons	181. 4	163. 0	172. 4	184. 2	178. 6	171. 6	184. 8	180. 4	148. 2	143. 6	152. 0	162. 8	2, 023. 0
Asphalt do	471. 2	420. 9	467. 1	524. 0	631. 1	681. 1	790. 2	772. 6	662. 9	650. 0	564. 4	491. 1	7, 126. 6
Still gas millions of cubic feet	32, 882	30, 229	34, 387	33, 268	34, 106	34, 136	34, 697	32, 648	26, 348	25, 222	27, 425	27, 101	372, 449
Road oil	123	94	154	192	269	361	220	374	386	316	99	98	2, 686
Other finished products	1, 932	1, 834	1, 776	1, 775	1, 735	1, 784	1, 691	1, 335	1, 143	1, 202	1, 463	1, 410	19, 080
Unfinished gasoline (net)	[2] 419	[2] 805	[2] 191	[2] 642	28	860	[2] 917	[2] 1, 389	[2] 648	[2] 319	[2] 317	[2] 133	[2] 4, 892
Other unfinished oils (net)	[2] 1, 590	[2] 1, 479	[2] 393	679	50	400	[2] 436	[2] 549	17	646	[2] 2, 135	[2] 937	[2] 5, 727
Shortage	1, 070	730	923	1, 112	851	711	1, 021	685	159	[4] 17	[4] 332	41	6, 954
Total output	151, 451	140, 339	152, 423	149, 298	158, 409	155, 747	161, 591	159, 007	133, 317	137, 050	144, 130	147, 096	1, 789, 858

[1] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.
[2] Negative quantity; represents net excess rerun over production.
[3] Subject to revision.
[4] Negative quantity (overage).

Runs to stills and production at refineries in the United States of the various refined products, 1944–45, by districts

[Thousands of barrels, except as otherwise indicated]

	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Oklahoma, Kansas, and Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas-Louisiana Inland	Rocky Mountain	California	United States
1944											
Input:											
Crude petroleum	257, 046	56, 349	278, 785	133, 106	82, 529	409, 391	84, 481	28, 028	41, 254	294, 715	1, 665, 684
Natural gasoline	2, 073	410	8, 911	4, 850	8, 272	20, 241	4, 589	1, 768	1, 149	14, 944	67, 207
Total input	259, 119	56, 759	287, 696	137, 956	90, 801	429, 632	89, 070	29, 796	42, 403	309, 659	1, 732, 891
Output:											
Gasoline	90, 371	24, 163	142, 276	68, 289	46, 519	174, 239	36, 324	10, 686	19, 984	109, 867	722, 718
Kerosine	9, 458	3, 894	13, 665	7, 767	4, 516	22, 330	10, 539	2, 512	950	2, 713	78, 344
Distillate fuel oil	46, 763	6, 313	34, 544	19, 281	5, 303	73, 935	15, 572	3, 726	4, 333	29, 382	239, 152
Residual fuel oil	79, 964	9, 194	56, 890	23, 984	23, 792	97, 683	16, 322	6, 447	11, 233	135, 946	461, 455
Lubricating oil	8, 237	5, 278	4, 526	4, 627	208	10, 614	2, 157	1, 438	256	3, 765	41, 106
Wax [1]	1, 024	366	222	303	9	461	356		88	54	2, 883
Coke [1]	11	124	5, 552	689	588	766	693		234	360	9, 017
Asphalt [1]	7, 633	1, 836	7, 806	3, 432	1, 686	2, 046	1, 688	2, 216	1, 751	8, 385	38, 479
Still gas [1]	14, 028	3, 422	18, 415	7, 038	4, 233	31, 935	8, 184	1, 291	1, 905	11, 788	102, 239
Wax ... thousands of pounds	286, 720	102, 480	62, 160	84, 840	2, 520	129, 080	99, 680		24, 640	15, 120	807, 240
Coke ... thousands of short tons	2. 2	24. 8	1, 110. 4	137. 8	117. 6	153. 2	138. 6		46. 8	72. 0	1, 803. 4
Asphalt ... do	1, 387. 7	333. 7	1, 419. 4	624. 1	306. 4	372. 0	306. 9	402. 9	318. 4	1, 524. 6	6, 996. 1
Still gas ... millions of cubic feet	50, 501	12, 319	66, 294	25, 337	15, 239	114, 966	29, 462	4, 648	6, 858	42, 437	368, 061
Road oil	95		32	45		2	1	19	569	793	1, 556
Other finished products	3, 831	978	1, 481	562	999	5, 995	2, 300	784	110	1, 396	18, 436
Unfinished gasoline (net)	[2] 619	[2] 65	491	[2] 274	1, 529	[2] 714	891	20	69	417	1, 745
Other unfinished oils (net)	[2] 3, 128	62	860	59	[2] 435	9, 470	[2] 5, 533	392	147	690	2, 584
Shortage	1, 451	1, 194	936	2, 154	1, 854	870	[3] 424	265	774	4, 103	13, 177
Total output	259, 119	56, 759	287, 696	137, 956	90, 801	429, 632	89, 070	29, 796	42, 403	309, 659	1, 732, 891

1945 [4]											
Input:											
Crude petroleum	273,667	56,199	275,853	139,176	84,510	403,417	99,309	27,937	45,944	313,522	1,719,534
Natural gasoline	1,687	435	8,309	5,310	10,043	20,334	3,325	2,238	1,502	17,141	70,324
Total input	275,354	56,634	284,162	144,486	94,553	423,751	102,634	30,175	47,446	330,663	1,789,858
Output:											
Gasoline	98,207	25,895	143,826	72,746	48,959	185,744	44,552	11,573	21,864	121,094	774,460
Kerosine	10,755	3,288	12,719	8,039	4,626	22,924	12,178	2,546	1,117	2,832	81,024
Distillate fuel oil	50,243	6,101	34,601	20,500	6,146	73,677	19,710	3,409	5,135	29,702	249,224
Residual fuel oil	85,352	9,152	53,494	24,764	22,491	88,617	17,062	6,331	13,253	148,976	469,492
Lubricating oil	8,358	4,891	4,446	5,361	248	10,989	2,036	1,453	265	3,820	41,867
Wax [1]	1,105	366	215	322	8	436	294	----------	90	85	2,921
Coke [1]	368	151	5,694	743	631	1,004	705	----------	194	625	10,115
Asphalt [1]	8,812	1,733	7,978	3,693	1,735	1,730	2,249	2,217	1,594	7,455	39,196
Still gas [1]	13,763	3,509	17,433	7,358	4,480	30,063	9,507	1,683	2,254	13,408	103,458
Wax, thousands of pounds	309,400	102,480	60,200	90,160	2,240	122,080	82,320	----------	25,200	23,800	817,880
Coke, thousands of short tons	73.6	30.2	1,138.8	148.6	126.2	200.8	141.0	----------	38.8	125.0	2,023.0
Asphalt, do	1,602.2	315.1	1,450.7	671.5	315.2	314.7	408 9	403.0	289.9	1,355.4	7,126.6
Still gas, millions of cubic feet	49,547	12,632	62,759	26,489	16,128	108,227	34,225	6,059	8,114	48,269	372,449
Road oil	289	----------	539	298	----------	26	1	37	821	675	2,686
Other finished products	3,388	728	1,485	364	1,951	6,219	2,882	175	116	1,772	19,080
Unfinished gasoline (net)	[2] 1,234	146	318	[2] 669	2,253	[2] 2,793	[2] 660	[2] 22	[2] 66	[2] 2,165	[2] 4,892
Other unfinished oils (net)	[2] 3,661	[2] 101	735	[2] 902	[2] 752	5,485	[2] 6,343	832	6	[2] 1,026	[2] 5,727
Shortage	[3] 391	775	679	1,869	1,777	[3] 370	[3] 1,539	[3] 59	803	3,410	6,954
Total output	275,354	56,634	284,162	144,486	94,553	423,751	102,634	30,175	47,446	330,663	1,789,858

[1] Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton; 3,600 cubic feet of still gas to the barrel.
[2] Negative quantity; represents net excess rerun over production.
[3] Negative quantity (overage).
[4] Subject to revision.

The representative prices of refined products in 1945 showed no changes in the first half of the year, but some readjustments were made beginning with August. The price of Regular Grade gasoline at Oklahoma refineries was 5.88 cents per gallon for the first 8 months of the year, rose to 5.99 cents in September and 6 cents in October, and declined to 5.92 cents in November and 5.81 cents in December. The tank-wagon price of kerosine at Chicago remained 10.60 cents per gallon through July, declined to 10.50 cents in August and to 10.30 cents in September and October, and rose to 10.55 cents in November and 10.60 cents in December. The price of bright stock at Oklahoma refineries remained at 22.75 cents per gallon during the year. The price of Bunker "C" fuel oil at New York was \$1.77 per barrel for the first 8 months of the year and declined to \$1.55 in September and October, to \$1.54 in November, and to \$1.51 in December.

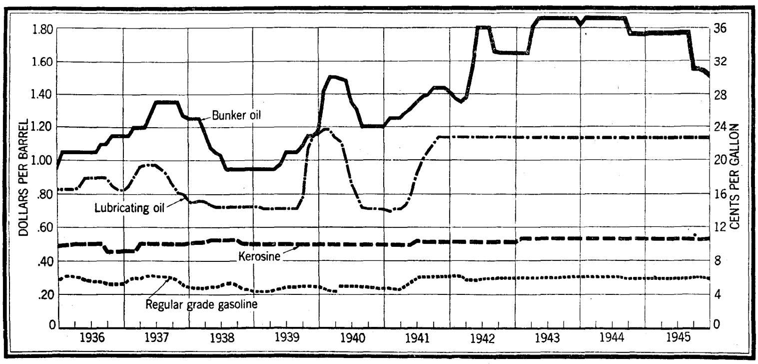

FIGURE 7.—Prices of Bunker "C" oil at New York, bright stock at Oklahoma refineries, tank-wagon price of kerosine at Chicago, and Regular Grade gasoline at refineries in Oklahoma, 1936–45, by months.

Summary of refinery capacity in the United States, January 1, 1940–45

Year	Number of refineries				Capacity (barrels per day)			
	Operating	Shut down	Building	Total	Operating	Shut down	Building	Total
1940	461	86	10	557	4,196,694	431,952	92,567	4,721,213
1941	420	136	6	562	4,180,588	538,381	141,225	4,860,194
1942	430	92	1	523	4,496,843	459,756	43,400	4,999,999
1943	386	85	1	472	4,409,013	492,998	195,100	5,097,111
1944	384	68	----------	452	4,709,382	383,641	118,270	5,211,293
1945 [1]	----------	----------	----------	----------	----------	----------	----------	----------

[1] Not available.

AVIATION GASOLINE

The wartime expansion in the production and use of aviation gasoline was much greater than the increase in demand for other petroleum products because of the growth of the use of air power in war. The total demand for aviation gasoline (domestic demand plus exports) rose from a daily average of 49,000 barrels in 1941 to a peak of 701,000 barrels daily in April 1945. Since these requirements follow a war-use pattern, it is necessary to divide the months of 1945 into two parts

Comparative analyses of statistics for aviation gasoline in the United States, 1944–45, by months

[Thousands of barrels]

1944	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1944	1943
Production:														
100-octane and above [1]	7,483	8,291	8,733	9,761	10,414	11,502	12,414	13,092	12,914	14,597	12,798	14,131	136,130	62,044
Other grades	5,482	4,575	5,734	5,434	5,455	5,145	4,878	5,442	5,465	4,597	3,861	4,185	60,253	44,179
Transfers out	172	221	410	413	360	417	152	240	248	231	497	582	3,943	2,175
Exports [2]	3,290	3,241	3,573	4,060	4,215	6,105	5,317	6,707	5,622	7,095	4,150	3,775	57,150	23,516
Stocks:														
100-octane and above	3,088	2,907	3,102	3,788	4,123	3,742	3,440	3,867	4,396	5,076	4,025	5,096	5,096	3,016
Other grades	10,196	9,966	9,508	9,725	9,705	9,158	8,596	8,895	8,898	9,277	9,238	10,050	10,050	9,468
Domestic demand: All grades	8,703	9,815	10,747	9,819	10,979	11,053	12,687	10,861	11,977	10,809	13,102	12,076	132,628	79,944
Total demand by grades:														
100-octane and above [1]	7,408	8,468	8,529	9,065	10,064	11,881	12,746	12,705	12,443	13,928	13,848	13,055	134,140	60,992
Other finished	4,011	4,049	5,511	4,549	4,657	4,887	4,801	4,398	4,638	3,585	2,835	2,295	50,216	37,929
Components	574	539	280	265	473	390	457	465	518	391	569	501	5,422	4,539
1945 [3]	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**1945**	**1944**
Production:														
100-octane and above	14,731	13,673	15,644	15,531	16,525	15,332	15,364	12,454	3,566	970	278	147	124,215	136,130
Other grades	3,181	3,366	3,563	2,508	2,663	1,914	3,176	715	409	1,831	2,366	2,488	28,180	60,253
Transfers out	363	348	426	683	298	372	472	1,275	2,929	1,314	1,336	1,346	11,162	3,943
Exports	4,538	4,450	5,998	7,316	4,905	3,565	1,616	520	70	143	388	293	33,802	[2] 57,150
Stocks:														
100-octane and above	6,242	7,858	7,407	4,943	5,998	6,576	7,722	7,904	2,822	2,029	1,626	1,450	1,450	5,096
Other grades	10,180	10,599	10,943	9,739	9,434	8,674	9,183	7,290	3,691	3,385	3,517	3,822	3,822	10,050
Domestic demand: All grades	11,735	10,206	12,890	13,708	13,235	13,491	14,797	13,085	9,657	2,443	1,191	867	117,305	132,628
Total demand by grades:														
100-octane and above	13,580	12,055	16,094	17,989	15,470	14,753	14,216	12,172	8,638	1,733	676	298	127,674	134,140
Other finished	2,072	2,011	2,096	2,260	1,872	1,869	1,653	1,137	807	721	686	709	17,893	50,216
Components	621	590	698	775	798	434	544	296	282	132	217	153	5,540	5,422

[1] Includes some 98 and 99 octane.
[2] Exports of 80–87 octane aviation gasoline (Census classification—medium octane aviation) have not been included for 1943–44, since the only available figures include large but indeterminate amounts of automotive gasoline.
[3] Subject to revision.

to get a picture of the changes within the year. Total demand dropped from a daily average of 560,000 barrels for the first 8 months to 123,000 barrels for the last 4 months, with 37,000 barrels daily in December.

The production of all aviation grades increased from an average of 58,000 barrels daily in 1941 to an average of 537,000 barrels daily in 1944 and 620,000 barrels daily in the peak month of March 1945. The average production for the first 8 months of 1945 was 578,000 barrels daily compared with 99,000 barrels daily for the last 4 months. The greatest monthly decrease came between the August daily average production of 425,000 barrels and the 133,000-barrel average in September.

As a result of the abrupt curtailment of military demand in the last 4 months of 1945, the total quantity of aviation gasoline, including components, transferred to other products was abnormally large, amounting to 57 percent of production compared with 3 percent in the first 8 months. These transfers in the last 4 months plus total demand exceeded production by 81,000 barrels daily, causing a drop in stocks from 15 million barrels on August 31 to 5 million at the end of the year.

Exports of all grades of aviation gasoline averaged 135,000 barrels daily in the first 8 months of 1945, with 244,000 barrels daily in April, and dropped to an average of 7,000 barrels daily in the last 4 months of the year, with a low of only 2,000 barrels daily in September. Almost all of the wartime exports went to other Allied Nations.

Domestic demand (including military use in the continental United States and shipments to our armed forces abroad) amounted to 117 million barrels in 1945, a decline of 15 million barrels from the peak year 1944. However, the daily average for the first 8 months in 1945 was 424,000 barrels, compared with 362,000 barrels in 1944. Domestic demand was reduced each month after the end of the war, reaching a low of 28,000 barrels daily in December. The average for the last 4 months of 1945 was 116,000 barrels daily. Improvements in quality of product accompanied the gains made in the quantity of aviation gasoline produced in the war years. The production of 100-octane or above constituted about 40 percent of the total production in 1941 and rose to 85 percent of the total produced in the first 8 months of 1945.

MOTOR FUEL

The total demand for motor fuel in 1945 was 785 million barrels or 52 million above the previous high in 1944. In the 24-year period from 1918 through 1941, this total demand for motor fuel rose from less than 100 million barrels per year to 695 million barrels, with very little deviation from the general trend, except in the depression years 1930–34. War conditions in 1942 caused a decrease in the total number of motor vehicles, a tire shortage, a decline in the normal transportation of gasoline by tankers, and gasoline rationing. The result was a drop in civilian gasoline demand for the first time in 10 years. Since military requirements were still relatively low in 1942 and since exports showed only small gains over 1941, the final result was a drop of 70 million barrels in total motor-fuel demand for the year. There was a further decline of 4 million barrels in 1943. The 113-million-barrel increase in 1944 was an all-time record for yearly gains, and the total motor-fuel demand was higher than in any previous year. Several factors caused this demand for 733 million barrels of motor fuel.

Decreased tanker losses made it possible to supply the growing wartime needs of the other Allied Nations; as a result, motor-fuel exports (including shipments to noncontiguous territories) were almost twice as large as in 1943. The planned program, designed to satisfy the growing military demand for aviation gasoline, was on schedule. Mechanized warfare had created a peak military demand for automotive-type gasoline, and essential transportation at home was using more motor fuel to keep war production at the necessary level. These same conditions existed in the wartime portion of 1945. The peak of this year came in August, when the average total motor-fuel demand was 2,355,000 barrels per day. Military and export demands dropped after the end of the war, but the removal of gasoline rationing at home caused an increase in civilian consumption. The high wartime requirements in the first part of 1945 and the increased civilian demand in the latter part of the year resulted in a gain of 52 million barrels or a total yearly demand of 785 million barrels, another all-time high.

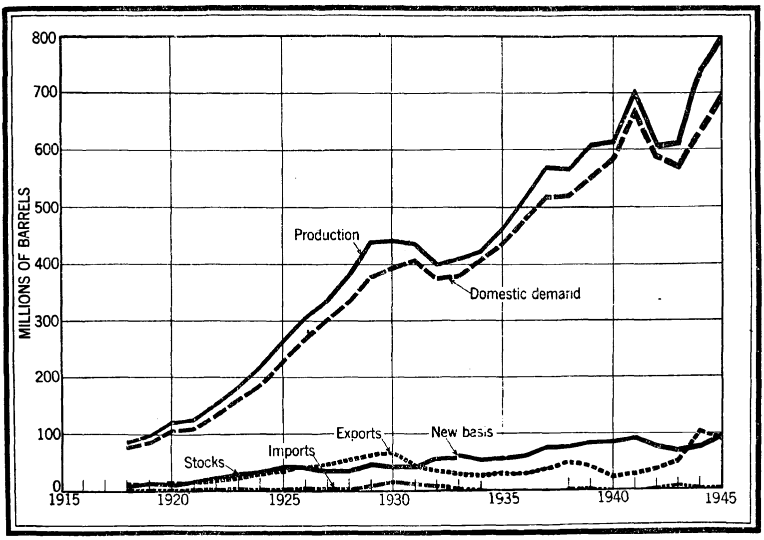

FIGURE 8.—Trends of production, domestic demand, exports, imports, and stocks of motor fuel in the United States, 1918–45.

Exports.—Exports of motor fuel (including shipments to noncontiguous Territories) averaged 141,000 barrels daily in 1943, increased to 275,000 barrels daily in 1944, were 337,000 barrels daily in the first 7 months of 1945, and dropped to 114,000 barrels daily in the last 5 months of the year. The total for 1945 was 89 million barrels, compared with 101 million in 1944. The peak month of 1945 was April, with a daily average of 419,000 barrels. Shipments to noncontiguous Territories were 1.8 million barrels in 1945, compared with 2.3 million in 1944. These shipments do not include military liftings of gasoline for the Territories. The major part of total exports of motor fuel went to other Allied Nations. Exports to the United Kingdom were 62.1 million barrels or 70 percent of the total in 1945, compared with 75.9 million or 75 percent in 1944.

Comparative analyses of statistics for motor fuel in the United States in 1944, by months

[Thousands of barrels]

	1944						
	January	February	March	April	May	June	July
Production:							
Refinery gasoline:							
Cracked	30,896	29,888	31,905	30,492	31,510	31,959	33,062
Straight-run	20,679	19,857	21,148	21,185	22,352	22,510	22,748
Natural gasoline, etc	7,821	7,565	8,050	7,828	8,277	8,187	8,567
Less L. P. G. sales and transfers of cycle products [1]	1,633	1,648	1,575	1,526	1,492	1,444	1,393
Benzol	200	200	200	200	200	200	200
Total production	57,963	55,862	59,728	58,179	60,847	61,412	63,184
Daily average	1,870	1,926	1,927	1,939	1,963	2,047	2,038
Imports	12	10	262	475	925	262	138
Exports	5,154	5,650	5,364	7,315	9,438	11,640	9,580
Daily average	166	195	173	244	304	388	309
Stocks, end of period:							
Finished gasoline	69,390	72,909	75,275	76,638	74,519	70,246	68,921
Natural gasoline	4,296	4,245	4,242	4,213	4,436	4,477	4,425
Total stocks	73,686	77,154	79,517	80,851	78,955	74,723	73,346
Domestic demand	47,540	46,754	52,263	50,005	54,230	54,266	55,119
Daily average	1,534	1,612	1,686	1,667	1,749	1,809	1,778

	1944—Continued						1943 (total)
	August	September	October	November	December	Total	
Production:							
Refinery gasoline:							
Cracked	33,769	32,283	33,190	33,055	33,558	385,567	314,454
Straight-run	22,655	23,827	24,421	24,019	24,543	269,944	216,773
Natural gasoline, etc	8,592	8,448	8,890	8,824	8,997	100,046	87,716
Less L. P. G. sales and transfers of cycle products [1]	1,395	1,417	1,524	1,649	1,921	18,617	[2] 13,163
Benzol	200	200	200	200	200	2,400	2,400
Total production	63,821	63,341	65,177	64,449	65,377	739,340	608,180
Daily average	2,059	2,111	2,102	2,148	2,109	2,020	1,666
Imports	227	373	55	320	89	3,148	5,736
Exports	11,025	9,094	11,087	7,407	7,783	100,537	51,577
Daily average	356	303	358	247	251	275	141
Stocks, end of period:							
Finished gasoline	66,542	64,914	65,886	68,107	73,622	73,622	63,864
Natural gasoline	4,211	4,141	4,160	4,334	4,252	4,252	4,541
Total stocks	70,753	69,055	70,046	72,441	77,874	77,874	68,405
Domestic demand	55,616	56,318	53,154	54,967	52,250	632,482	568,238
Daily average	1,794	1,877	1,715	1,832	1,685	1,728	1,557

[1] Includes L. P. G. sales for fuel and chemical uses.
[2] Includes L. P. G. sales for fuel only.

Comparative analyses of statistics for motor fuel in the United States in 1945, by months

[Thousands of barrels]

	1945 [1]						
	January	February	March	April	May	June	July
Production:							
Refinery gasoline:							
Cracked	34,262	32,255	34,655	33,177	34,427	34,263	35,696
Straight-run	24,267	23,733	25,037	24,553	27,006	24,644	28,457
Natural gasoline, etc	9,603	8,753	9,523	9,258	9,707	9,281	9,517
Less L. P. G. sales and transfers of cycle products [2]	1,710	1,478	1,500	1,458	1,614	1,460	1,405
Benzol	240	240	240	240	240	240	240
Total production	66,662	63,503	67,955	65,770	69,766	66,968	72,505
Daily average	2,150	2,268	2,192	2,192	2,251	2,232	2,339
Imports	141	201	110	87	299	352	142
Exports	10,714	7,637	12,409	12,572	11,649	9,935	6,443
Daily average	346	273	400	419	376	331	208
Stocks, end of period:							
Finished gasoline	78,877	85,473	85,654	79,653	77,151	74,089	74,460
Natural gasoline	4,160	4,618	4,644	4,783	4,873	4,723	4,338
Total stocks	83,037	90,091	90,298	84,436	82,024	78,812	78,798
Domestic demand	51,125	49,013	55,449	59,147	60,828	60,597	66,218
Daily average	1,649	1,750	1,789	1,972	1,962	2,020	2,136

	1945—Continued [1]						1944 (total)
	August	September	October	November	December	Total	
Production:							
Refinery gasoline:							
Cracked	34,829	29,307	29,918	34,496	34,504	401,789	385,567
Straight-run	29,263	23,600	23,141	24,761	23,885	302,347	269,944
Natural gasoline, etc	9,411	8,329	9,027	9,234	9,631	111,274	100,046
Less L. P. G. sales and transfers of cycle products [2]	1,425	1,399	1,722	1,858	2,202	19,231	18,617
Benzol	240	240	240	240	240	2,880	2,400
Total production	72,318	60,077	60,604	66,873	66,058	799,059	739,340
Daily average	2,333	2,003	1,955	2,229	2,131	2,189	2,020
Imports	202	69	105	99	----------	1,807	3,148
Exports	2,973	4,440	2,442	2,973	4,663	88,850	100,537
Daily average	96	148	79	99	150	243	275
Stocks, end of period:							
Finished gasoline	74,270	65,489	68,039	78,091	89,360	89,360	73,622
Natural gasoline	4,048	3,985	3,959	4,325	4,322	4,322	[3] 4,451
Total stocks	78,318	69,474	71,998	82,416	93,682	93,682	78,073
Domestic demand	70,027	64,550	55,743	53,581	50,129	696,407	632,482
Daily average	2,259	2,152	1,798	1,786	1,617	1,908	1,728

[1] Subject to revision.
[2] Includes L. P. G. sales for fuel and chemical uses.
[3] New basis to compare with subsequent months; a transfer of 199,000 barrels of California condensate from crude-oil stocks.

Domestic demand.—Domestic demand for motor fuel (including military consumption in continental United States and all shipments to our armed forces abroad) increased 63.9 million barrels in 1945 to reach a total of 696,407,000 barrels for the year. This gain, combined with the 1944 increase, produced a total gain of 128 million barrels in the last 2 years, compared with the decline of 99 million in the 2 years 1942–43 and a net gain of 29 million for 1945 over 1941. Although it is not possible to divide domestic demand into military and civilian requirements, we do know that most of the demand for aviation gasoline was military, either for our armed forces or those of other Allied Nations. The daily average domestic demand for all grades of aviation gasoline dropped 58 percent in the last 5 months of 1945, compared with the daily average for the first 7 months, while other gasolines included in motor fuel increased 18 percent for the same period. Military demands for motor fuel were reduced by the end of the European War and more automotive gasoline was available for civilian use. The end of the Pacific War caused further declines in military requirements, but the removal of all civilian gasoline rationing brought sharp increases in automotive demand to more than offset the gradual reduction of military purchases. This resulted in high domestic demands for motor fuel in August and September and produced a small net increase in the daily average for the last 5 months of the year compared with the daily average for the first 7 months.

Production.—The total production of motor fuel in 1945 was 799,059,000 barrels, a gain of 59,719,000 barrels over the previous record set in 1944. This 1945 production comprised 401,789,000 barrels of cracked gasoline, 302,347,000 barrels of straight-run gasoline, 92,043,000 barrels of net natural gasoline and cycle-plant products (after deducting transfers and sales of liquefied gases for fuel and chemical purposes), and 2,880,000 barrels of benzol. The gain in production of straight-run gasoline was 32 million barrels compared with a 16-million-barrel increase in cracked gasoline. Peak production of motor fuel came in July, when the daily average rose to 2,339,000 barrels. Decreased refinery operations in September and October caused production to drop to an average of 1,978,000 barrels daily for the 2-month period, compared with an average of 2,179,000 barrels daily in November and December.

Yields.—The yield of straight-run gasoline from crude petroleum rose from 15.1 percent in 1943 to 16.2 percent in 1944 and to 17.6 percent in 1945, while the yield of cracked gasoline increased from 22.0 percent in 1943 to 23.2 percent in 1944 and to 23.3 percent in 1945. The total gasoline yield from crude was 37.1 percent in 1943 and 39.4 percent in 1944, compared with 40.9 percent in 1945, and the average yield for November and December in 1945 was 41.9 percent compared with 40.4 percent for the same period in 1944. These high yields in the last 2 months of 1945 contributed to a production surplus that was above normal and gave a very large stock increase for the period.

Production of gasoline in the United States in 1945, by methods of manufacture, districts, and months [1]

[Thousands of barrels]

Method and district	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cracked:													
East Coast	5,023	4,778	5,209	5,371	5,065	5,287	5,151	5,541	4,565	5,367	5,319	5,220	61,896
Appalachian	1,284	1,314	1,414	1,324	1,329	1,216	1,268	1,223	1,127	1,094	1,399	1,453	15,445
Indiana, Illinois, Kentucky, etc	6,319	6,099	6,413	6,111	6,740	5,961	6,393	6,485	5,403	5,711	6,609	6,503	74,747
Oklahoma, Kansas, Missouri, etc	3,197	2,847	3,167	2,799	3,178	3,040	3,102	3,074	2,870	3,041	2,972	2,987	36,274
Texas Inland	1,498	1,475	1,384	1,559	1,646	1,539	1,637	1,862	1,747	1,738	1,666	1,680	19,431
Texas Gulf Coast	8,288	8,334	8,570	7,996	7,922	8,651	8,903	8,097	5,597	5,914	8,764	8,555	95,591
Louisiana Gulf Coast	2,085	1,821	2,237	2,032	2,213	2,419	2,615	2,221	2,073	1,827	1,982	1,911	25,436
Arkansas and Louisiana Inland	395	357	333	483	351	374	396	293	390	405	336	317	4,430
Rocky Mountain	868	870	832	712	844	724	804	1,069	855	824	1,044	864	10,310
California	5,305	4,360	5,096	4,790	5,139	5,052	5,427	4,964	4,680	3,997	4,405	5,014	58,229
Total cracked	34,262	32,255	34,655	33,177	34,427	34,263	35,696	34,829	29,307	29,918	34,496	34,504	401,789
Percent yield [2]	23.6	23.9	23.7	23.2	22.6	22.9	23.0	22.8	22.9	22.7	24.9	24.3	23.3
Straight-run:													
East Coast	2,758	2,462	2,969	2,943	2,918	2,193	3,160	3,480	2,896	2,906	3,235	2,704	34,624
Appalachian	837	661	724	846	932	890	923	1,060	842	673	807	820	10,015
Indiana, Illinois, Kentucky, etc	5,238	4,814	5,032	5,221	5,418	5,236	5,980	5,690	4,278	4,648	4,825	4,390	60,770
Oklahoma, Kansas, Missouri, etc	2,632	2,544	2,531	2,401	2,712	2,694	2,681	2,975	2,607	2,433	2,259	2,693	31,162
Texas Inland	1,849	1,658	1,712	1,857	1,902	1,829	1,987	1,722	1,368	1,288	1,246	1,067	19,485
Texas Gulf Coast	5,254	5,826	6,082	5,718	6,455	5,362	6,582	6,606	4,660	4,635	6,273	6,366	69,819
Louisiana Gulf Coast	1,362	1,272	1,308	707	1,162	853	998	1,328	1,716	1,786	1,543	1,756	15,791
Arkansas, Louisiana Inland, and Mississippi	416	362	438	284	459	483	469	530	491	429	276	268	4,905
Rocky Mountain	836	813	956	799	899	1,059	963	851	728	781	618	749	10,052
California	3,085	3,321	3,285	3,777	4,149	4,045	4,714	5,021	4,014	3,562	3,670	3,072	45,724
Total straight-run	24,267	23,733	25,037	24,553	27,006	24,644	28,457	29,263	23,600	23,141	24,761	23,885	302,347
Percent yield [2]	16.7	17.6	17.1	17.1	17.7	16.5	18.4	19.2	18.4	17.6	17.8	16.9	17.6
Total production, including natural gasoline blended at refineries:													
East Coast	8,042	7,474	8,432	8,450	8,122	7,685	8,542	9,118	7,481	8,304	8,602	7,955	98,207
Appalachian	2,159	2,010	2,170	2,202	2,289	2,136	2,216	2,312	2,003	1,815	2,258	2,325	25,895
Indiana, Illinois, Kentucky, etc	12,360	11,707	12,162	12,105	12,890	11,854	13,057	12,906	10,320	10,882	12,101	11,482	143,826
Oklahoma, Kansas, Missouri, etc	6,290	5,690	6,142	5,554	6,293	6,211	6,245	6,448	5,825	5,981	5,828	6,239	72,746
Texas Inland	4,025	3,841	3,995	4,235	4,429	4,209	4,534	4,459	4,037	4,053	3,624	3,518	48,959
Texas Gulf Coast	15,459	15,753	16,557	15,489	16,096	15,752	17,298	16,484	11,437	12,180	16,772	16,467	185,744
Louisiana Gulf Coast	3,830	3,400	3,780	2,985	3,657	3,594	4,051	3,935	3,969	3,796	3,712	3,843	44,552
Arkansas, Louisiana Inland and Mississippi	973	871	939	1,007	1,023	1,068	1,091	1,042	1,009	992	796	762	11,573
Rocky Mountain	1,798	1,763	1,937	1,637	1,885	1,941	1,915	2,079	1,734	1,711	1,755	1,709	21,864
California	9,973	8,936	9,716	10,143	10,863	10,522	11,755	11,545	10,173	8,828	9,234	9,406	121,094
Total United States: 1945	64,909	61,445	65,830	63,807	67,547	64,972	70,704	70,328	57,988	58,542	64,682	63,706	774,460
1944	56,957	54,369	58,430	56,689	59,060	59,898	61,975	62,508	61,909	63,631	63,183	64,109	722,718

[1] Subject to revision.

[2] Based upon crude runs to stills.

Prices.—Gasoline prices showed a very slight downward trend in 1945, most of the decreases coming near the end of the year.

The average group 3 refinery price for Regular-Grade gasoline dropped from a yearly average of 5.95 cents per gallon in 1944 to 5.90 cents per gallon in 1945. The price was constant for all months through August, rose slightly, and then dropped near the close of the year.

The average 50-city dealers' net price, exclusive of all taxes, dropped from an average of 10.49 cents per gallon in 1944 to 10.33 cents per gallon in 1945. The average price was constant at 10.46 cents per gallon through August and dropped to 10.07 cents for the remaining months of the year.

Average monthly prices of gasoline in the United States, 1944–45, in cents per gallon

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1944													
Monthly average at refineries in Oklahoma, 72 octane [1]	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.93	5.88	5.88	5.88	5.88	5.95
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	10.51	10.51	10.51	10.51	10.51	10.51	10.51	10.51	10.46	10.46	10.46	10.46	10.49
Service station (including State and local taxes only)	19.10	19.10	19.10	19.10	19.10	19.10	19.10	19.10	19.10	19.05	19.05	19.05	19.09
1945													
Monthly average at refineries in Oklahoma, 73–75 octane [1]	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.88	5.99	6.00	5.92	5.81	5.90
Average of 50 cities on 1st of month: [2]													
Dealers' net (ex. tax)	10.46	10.46	10.46	10.46	10.46	10.46	10.46	10.46	10.07	10.07	10.07	10.07	10.33
Service station (including State and local taxes only)	19.05	19.05	19.05	19.07	19.11	19.11	19.11	19.13	19.13	18.74	18.74	18.74	19.00

[1] National Petroleum News.
[2] American Petroleum Institute; compiled by The Texas Co.

The average 50-city service-station price, including State and local taxes but excluding Federal tax, was 19.09 cents per gallon in 1944 and declined to 19.00 cents in 1945. The monthly averages remained constant at 19.05 cents per gallon in the first quarter of 1945, rose until they reached 19.13 cents in August and September, then dropped to 18.74 cents for the months of the last quarter.

There was no change in the average tax rates in 1945 compared with 1944. The average local tax rate remained at 0.05 cent per gallon, the State tax at 4.42 cents per gallon, and the Federal tax at 1.50 cents per gallon for a total average tax rate of 5.97 cents per gallon.

Stocks.—Stocks of finished and unfinished gasoline amounted to 98 million barrels at the end of 1945, compared with 87 million at the close of 1944. This 11-million-barrel increase in gasoline stock comprised a 16-million-barrel gain in finished gasoline and a 5-million-barrel decrease in unfinished. In the first quarter of the year, stocks of finished and unfinished gasoline increased 11 million barrels, and this gain was balanced by a stock draft of 11 million in the second quarter. Most of the third quarter's drop of 12 million barrels came in September, when refinery production was low and the total gasoline demand was almost 150,000 barrels daily above the average for the year. Although both domestic demand and exports decreased in October, the daily average production of motor fuel was at the low point of the year to give a net increase in stocks of only 2 million

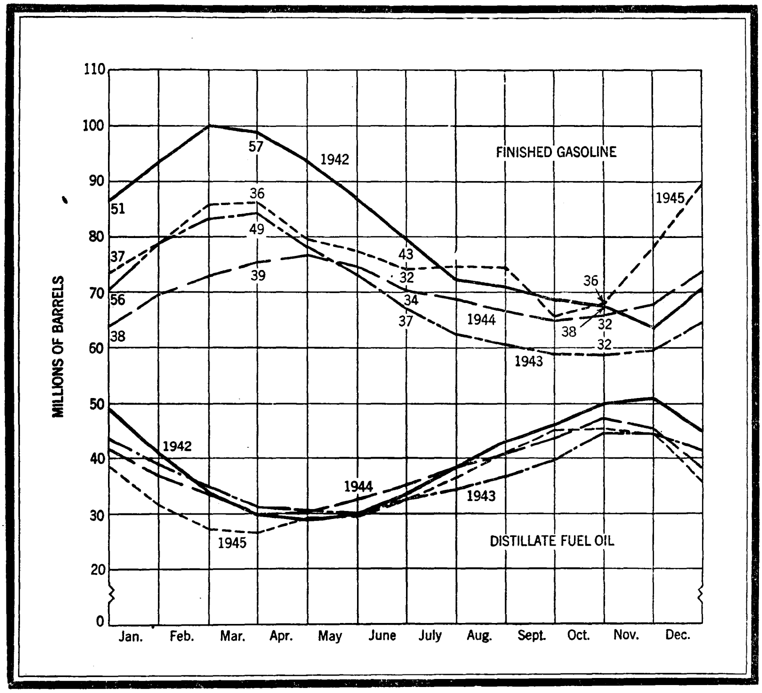

FIGURE 9.—Stocks of finished gasoline in the United States, 1942–45, by months, with figures representing days' supply at certain periods; also stocks of distillate fuel oil, 1942–45, by months.

Days' supply [1] of motor fuel on hand in the United States at end of month, 1943–45

Month	1943			1944			1945 [2]		
	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel	Finished gasoline	Natural gasoline	Total motor fuel
January	56.7	3.6	60.3	38.4	2.4	40.8	39.0	2.0	41.0
February	57.4	3.4	60.8	39.2	2.3	41.5	39.1	2.1	41.2
March	49.1	3.2	52.3	39.4	2.2	41.6	35.8	2.0	37.8
April	45.3	3.1	48.4	37.3	2.1	39.4	34.1	2.0	36.1
May	38.9	2.9	41.8	33.9	2.0	35.9	32.8	2.1	34.9
June	36.9	2.8	39.7	33.7	2.1	35.8	31.6	2.0	33.6
July	33.7	2.7	36.4	32.1	2.0	34.1	31.6	1.8	33.4
August	32.2	2.6	34.8	30.5	1.9	32.4	32.3	1.8	34.1
September	31.7	2.5	34.2	31.3	2.0	33.3	34.9	2.1	37.0
October	32.4	2.4	34.8	31.7	2.0	33.7	36.1	2.1	38.2
November	35.6	2.8	38.4	35.2	2.2	37.4	44.2	2.4	46.6
December	37.9	2.7	40.6	36.9	2.1	39.0	48.9	2.4	51.3

[1] Stocks divided by the daily average total demand (domestic demand plus exports) for succeeding month.
[2] Subject to revision; new stock basis for 1945 due to transfer of 199,000 barrels of California condensate from crude-oil stocks.

Stocks of gasoline in the United States in 1945, by districts and months [1]

[Thousands of barrels]

District	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Finished gasoline:[2]												
East Coast	11,413	12,310	11,960	11,877	12,413	12,223	12,993	13,915	12,206	14,368	17,378	18,841
Appalachian	3,743	3,792	3,528	3,519	4,087	3,878	3,419	3,241	3,190	2,645	3,259	3,678
Indiana, Illinois, Kentucky, etc	20,534	22,879	22,669	21,414	20,617	18,927	17,847	16,878	15,423	15,582	17,499	19,860
Oklahoma, Kansas, and Missouri	8,399	8,906	8,940	8,737	8,543	8,753	7,351	6,747	6,083	6,253	6,780	8,511
Texas Inland	2,101	2,441	2,050	2,190	2,295	2,052	2,052	2,015	1,864	2,086	2,309	2,482
Texas Gulf Coast	12,198	12,907	13,775	11,578	10,219	10,389	12,988	14,177	10,679	11,514	12,990	15,096
Louisiana Gulf Coast	4,169	4,858	4,874	4,144	3,897	3,482	3,897	3,504	2,848	2,742	3,406	4,500
Arkansas and Louisiana Inland	2,686	2,620	2,694	2,829	2,519	2,453	2,325	2,084	2,599	1,700	1,724	1,887
Rocky Mountain	1,783	2,219	2,459	2,317	2,169	2,132	1,911	1,600	1,355	1,243	1,534	1,919
California	11,851	12,541	12,705	11,048	10,392	9,800	9,677	10,109	9,242	9,906	11,203	12,586
Total finished gasoline	78,877	85,473	85,654	79,653	77,151	74,089	74,460	74,270	65,489	68,039	78,091	89,360
Unfinished gasoline:												
East Coast	1,721	1,786	1,671	1,658	1,496	1,347	1,413	1,236	1,076	932	1,013	872
Appalachian	447	437	389	414	395	386	393	433	405	426	443	514
Indiana, Illinois, Kentucky, etc	1,011	1,061	900	854	859	1,028	944	909	903	729	670	860
Oklahoma, Kansas, and Missouri	718	538	499	542	449	448	390	328	385	398	403	375
Texas Inland	355	461	516	433	474	476	390	384	370	481	495	501
Texas Gulf Coast	3,268	3,028	3,083	2,843	2,923	3,441	3,346	2,808	2,529	2,251	2,117	2,099
Louisiana Gulf Coast	589	391	387	449	416	450	432	361	325	292	317	343
Arkansas and Louisiana Inland	28	31	22	14	4	5	3	2	3	2	1	1
Rocky Mountain	213	225	231	225	247	229	243	175	158	152	139	137
California	4,439	4,026	4,095	3,719	3,916	4,229	3,568	3,097	2,931	3,103	2,851	2,614
Total unfinished gasoline	12,789	11,984	11,793	11,151	11,179	12,039	11,122	9,733	9,085	8,766	8,449	8,316
Total finished and unfinished:												
East Coast	13,134	14,096	13,631	13,535	13,909	13,570	14,406	15,151	13,282	15,300	18,391	19,713
Appalachian	4,190	4,229	3,917	3,933	4,482	4,264	3,812	3,674	3,595	3,071	3,702	4,192
Indiana, Illinois, Kentucky, etc	21,545	23,940	23,569	22,268	21,476	19,955	18,791	17,787	16,326	16,311	18,169	20,720
Oklahoma, Kansas, and Missouri	9,117	9,444	9,439	9,279	8,992	9,201	7,741	7,075	6,468	6,651	7,192	8,886
Texas Inland	2,456	2,902	2,566	2,623	2,769	2,528	2,442	2,399	2,234	2,567	2,804	2,983
Texas Gulf Coast	15,466	15,935	16,858	14,421	13,142	13,830	16,334	16,985	13,208	13,765	15,107	17,195
Louisiana Gulf Coast	4,758	5,249	5,261	4,593	4,313	3,932	4,329	3,865	3,173	3,034	3,723	4,843
Arkansas and Louisiana Inland	2,714	2,651	2,716	2,843	2,523	2,458	2,328	2,086	2,602	1,702	1,725	1,888
Rocky Mountain	1,996	2,444	2,690	2,542	2,416	2,361	2,154	1,775	1,513	1,395	1,673	2,056
California	16,290	16,567	16,800	14,767	14,308	14,029	13,245	13,206	12,173	13,009	14,054	15,200
Total United States: 1945	91,666	97,457	97,447	90,804	88,330	86,128	85,582	84,003	74,574	76,805	86,540	97,676
1944	81,309	84,752	87,247	88,373	86,712	81,984	80,502	78,466	76,986	78,274	80,574	86,830

[1] Subject to revision.

[2] Includes stocks of finished gasoline at refineries, bulk terminals, and in pipe lines.

barrels. Full refinery operation in November and December, combined with high percentage yields of gasoline and lower total motor-fuel demand, added 21 million barrels to gasoline inventories in the 2 months' period. If the November–December period in 1945 is compared with the same period in 1944, we find motor-fuel production up 3 million barrels in the 1945 period, while domestic demand was down 3.5 million and exports down 7.5 million. These factors produced the 21-million-barrel stock increase in the last 2 months of 1945 compared with the 8.6-million-barrel increase in the same period of 1944.

Gasoline stocks may be expressed in terms of days' supply by dividing the stocks at the end of the month by the daily average total demand for the succeeding month. Upon this basis the days' supply represented by finished gasoline stocks on December 31 was 51 days at the end of 1941 compared with 36.9 days at the end of 1944 and 48.9 days at the close of 1945. However, the closing inventory for 1945 came after a heavy 2-month stock build-up. Stocks of finished gasoline at the end of October represented only 36.1 days' supply.

The stocks included in these figures represent gasoline held at refineries and bulk terminals and by pipe lines but do not include gasoline that has passed into the custody of the armed forces.

Production and consumption by States.—The refinery production of gasoline in 1945 was 774,460,000 barrels, compared with 722,718,000 barrels in 1944. Texas again led all States, with a production of 234,703,000 barrels or 30 percent of the total, compared with 220,758,000 barrels or 31 percent of the total in 1944. California refinery production (including some production in Washington) increased from 109,867,000 barrels in 1944 to 121,094,000 barrels or 16 percent of the total in 1945. Only four States produced less gasoline at refineries in 1945 than in 1944, and the only important producing State showing a decline was Ohio, where the drop was from 36,001,000 barrels in 1944 to 34,691,000 in 1945.

Production and consumption of gasoline in the United States, 1943–45, by States

[Thousands of barrels]

State	1943		1944		1945 [1]	
	Production	Consumption [2]	Production	Consumption [2]	Production	Consumption [2]
Alabama	(3)	6,223	(3)	6,264	(3)	7,318
Arizona		3,043		3,078		3,168
Arkansas	3,392	4,272	3,116	4,268	3,668	5,117
California	[4] 91,783	59,366	[4] 109,867	57,565	[4] 121,094	65,760
Colorado	2,215	5,743	2,514	7,073	2,568	7,061
Connecticut		6,199		6,505		7,143
Delaware		1,143		1,195		1,308
District of Columbia		2,513		2,589		2,811
Florida		8,725		9,083		10,184
Georgia	[5] 4,289	8,308	[5] 7,518	8,979	[5] 8,268	9,947
Idaho	(6)	2,205	(6)	2,278	(6)	2,636
Illinois	[7] 43,646	27,728	[7] 53,145	27,770	[7] 54,582	30,315
Indiana	39,816	16,013	42,818	16,640	43,825	18,039
Iowa		11,534		12,496		14,239
Kansas	[8] 30,924	10,407	[8] 32,413	10,528	[8] 33,353	11,757
Kentucky	[9] 6,928	6,326	[9] 7,861	7,019	[9] 9,440	8,729
Louisiana	[3] 29,505	7,198	[3] 43,894	7,287	[3] 52,457	7,519
Maine		2,660		3,113		3,466
Maryland	(5)	6,447	(5)	7,033	(5)	7,831
Massachusetts	[10] 5,713	11,643	[10] 6,333	12,812	[10] 5,679	14,270

See footnotes at end of table.

Production and consumption of gasoline in the United States, 1943–45, by States—Continued

State	1943		1944		1945 [1]	
	Production	Consumption [2]	Production	Consumption [2]	Production	Consumption [2]
Michigan	10,427	23,306	11,103	25,806	10,381	27,896
Minnesota	(7)	10,534	(7)	11,029	(7)	12,671
Mississippi	(3)	4,850	(3)	4,899	(3)	5,608
Missouri	(8)	12,426	(8)	12,640	(8)	14,521
Montana	4,264	2,627	4,158	2,769	3,973	3,162
Nebraska	(8)	5,391	(8)	5,608	(8)	6,330
Nevada		1,006		1,466		1,233
New Hampshire		1,303		1,588		1,822
New Jersey	20,863	15,806	29,473	16,473	31,871	17,811
New Mexico	1,558	2,371	1,876	2,639	2,010	3,096
New York	7,323	30,192	8,371	33,155	9,632	35,500
North Carolina		9,112		9,721		11,372
North Dakota		3,670		4,074		4,544
Ohio	32,689	29,782	36,001	32,520	34,691	33,411
Oklahoma	29,392	9,526	35,876	11,379	39,393	13,619
Oregon		6,079		6,264		6,662
Pennsylvania	42,588	25,385	51,430	26,964	56,993	30,083
Rhode Island	(10)	2,465	(10)	2,873	(10)	2,965
South Carolina	(5)	4,492	(5)	5,208	(5)	5,628
South Dakota	(8)	3,113	(8)	3,182	(8)	4,013
Tennessee	(9)	7,574	(9)	7,951	(9)	9,113
Texas	174,206	62,494	220,758	97,718	234,703	98,313
Utah	(6)	2,432	(6)	2,490	(6)	2,865
Vermont		980		1,071		1,300
Virginia		9,175		10,317		11,002
Washington	(4)	9,597	(4)	8,989	(4)	9,891
West Virginia	2,466	3,626	2,757	3,799	2,566	4,508
Wisconsin	(7)	11,084	(7)	11,520	(7)	13,853
Wyoming	[6] 8,438	1,261	[6] 11,436	1,687	[6] 13,313	1,793
Total United States	592,425	519,355	722,718	579,374	774,460	633,203

[1] Subject to revision.
[2] American Petroleum Institute.
[3] Alabama and Mississippi included with Louisiana.
[4] Washington included with California.
[5] Maryland and South Carolina included with Georgia.
[6] Idaho and Utah included with Wyoming.
[7] Minnesota and Wisconsin included with Illinois.
[8] Missouri, Nebraska, and South Dakota included with Kansas.
[9] Tennessee included with Kentucky.
[10] Rhode Island included with Massachusetts.

The lack of information on military consumption at home and abroad makes it extremely difficult to compute total consumption of gasoline by States, since, in some cases, sales to the Government within a State ultimately may be shipped abroad.

Distribution.—Gasoline transportation changed in 1945 from wartime movements to more nearly normal distribution. Tanker and barge movements of commercial gasoline from the Gulf coast to East coast ports rose from 1,931,000 barrels in February to 9,813,000 barrels in November. The high-cost, but necessary, wartime movements by tank cars declined rapidly after the end of the war. The total motor fuel delivered by pipe lines increased in 1945, but the monthly deliveries ranged from 29,593,000 barrels in May to 14,897,000 barrels in December. The greatest drop came with the closing of the 20-inch war emergency pipe line, when deliveries declined from 25,826,000 barrels in August to 18,491,000 in September. Some other wartime lines and extensions were closed; and a few lines, where changes had been made in direction of flow to meet war needs, were again reversed to conform to normal patterns of distribution.

Shipments of motor fuel by pipe lines in the United States in 1945, by months

[Thousands of barrels]

	1945						
	January	February	March	April	May	June	July
Motor fuel turned into lines	27,082	24,075	27,559	28,287	29,871	26,631	26,831
Motor fuel delivered from lines	26,228	23,714	27,153	28,477	29,593	26,137	27,865
Shortage	74	98	107	22	35	90	134
Stocks in lines and working tanks, end of month	12,904	13,167	13,466	13,254	13,497	13,901	12,733

	1945—Continued						1944 (total)
	August	September	October	November	December	Total	
Motor fuel turned into lines	25,705	17,593	15,411	16,767	15,739	281,551	283,052
Motor fuel delivered from lines	25,826	18,491	17,877	15,857	14,897	282,115	278,280
Shortage	96	54	77	96	74	957	1,101
Stocks in lines and working tanks, end of month	12,516	11,564	9,021	9,835	10,603	10,603	12,124

KEROSINE AND RANGE OIL

A heavier domestic and foreign demand for kerosine in 1945 was practically all supplied from increased production, as the quantity taken from storage was negligible, and furthermore there were no imports.

Petroleum refiners produced 81,024,000 barrels of kerosine in 1945, a new record and a quantity of 3 percent above the 1944 total of 78,344,000 barrels. The yield of kerosine remained at 4.7 percent for both 1944 and 1945, so the expanded output must be credited entirely to an increase (3 percent) in the volume of crude runs to stills. It should be added that the percentage yield of kerosine and other petroleum products was kept down in 1945 as well as in 1944, so that more gasoline could be made to satisfy the unusual demand for motor fuel at the time.

The increased production of kerosine in 1945 resulted mostly from important gains reported for the East Coast and Louisiana Gulf Coast refinery districts. Petroleum companies operating in the East Coast area produced 14 percent more kerosine in 1945 than in 1944, while the output for the Louisiana Gulf Coast for 1945 was nearly 16 percent above the 1944 quantity. Over a quarter of the kerosine manufactured in the country originates in the Texas Gulf Coast district; however, the output there for 1945 was only slightly above the 1944 total, while the production reported for the Indiana-Illinois-Kentucky area, which ranks second as a source of this fuel, declined by 7 percent in 1945 compared with 1944. Petroleum refineries operating in the Oklahoma-Kansas-Missouri district produce about one-tenth of the total kerosine manufactured, and the output in those States in 1945 was about 4 percent over the 1944 yield. Relatively less important quantities of kerosine are produced in the other refinery districts of the country, and these latter areas all showed gains in output in 1945, except the Appalachian area, where the kerosine total reported was approximately 16 percent below the 1944 quantity.

Comparative analyses of statistics for kerosine in the United States, 1944–45, by months and districts

Month and district	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]
By months:								
January	7,071	6,614	5.3	4.6	7,987	8,831	8,257	8,742
February	6,413	6,291	5.1	4.7	7,255	7,600	7,259	7,150
March	6,960	7,056	5.0	4.8	7,480	6,780	6,567	6,925
April	6,489	6,260	4.9	4.4	5,912	4,521	6,722	8,252
May	6,710	6,445	4.8	4.2	5,030	5,459	8,117	8,574
June	6,246	6,337	4.5	4.2	4,139	4,741	9,825	9,599
July	6,277	6,520	4.4	4.2	3,574	4,402	11,799	11,157
August	6,358	7,089	4.4	4.6	3,874	3,789	13,339	13,894
September	6,339	5,858	4.5	4.6	4,694	5,254	14,648	13,675
October	6,515	6,447	4.5	4.9	6,307	6,775	14,454	12,708
November	6,505	7,564	4.6	5.5	6,750	7,613	13,771	12,141
December	6,461	8,543	4.5	6.0	8,810	9,830	11,150	10,421
Total United States	78,344	81,024	4.7	4.7	71,812	75,595	11,150	10,421
By districts:								
East Coast	9,458	10,755	3.7	3.9	(2)	(2)	4,359	3,894
Appalachian	3,894	3,288	6.9	5.9			561	302
Indiana, Illinois, Kentucky, etc.	13,665	12,719	4.9	4.6			2,362	1,769
Oklahoma, Kansas, and Missouri	7,767	8,039	5.8	5.8			704	583
Texas Inland	4,516	4,626	5.5	5.5			198	237
Texas Gulf Coast	22,330	22,924	5.5	5.7			1,205	1,817
Louisiana Gulf Coast	10,539	12,178	12.5	12.3			985	999
Arkansas and Louisiana Inland	2,512	2,546	9.0	9.1			148	221
Rocky Mountain	950	1,117	2.3	2.4			127	103
California	2,713	2,832	0.9	0.9			501	496
Total United States	78,344	81,024	4.7	4.7	71,812	75,595	11,150	10,421

[1] Subject to revision.
[2] Figures not available.

A rising domestic demand for kerosine noted in 1944 continued into 1945, when requirements of 75,595,000 barrels were 5 percent over the 1944 total of 71,812,000 barrels. It should be added that this expanding market for kerosine was also evident in the first quarter of 1946, as monthly figures indicate an increase of 24 percent over the corresponding period of 1945. The domestic demand for kerosine by refinery districts cannot be determined definitely as several factors, such as the intermovement between the different areas and the imports and exports for each district, are not readily available.

Exports of kerosine, which varied very little in 1944 compared with 1943, mounted noticeably in 1945, when the foreign demand totaled 6,158,000 barrels, a gain of 26 percent over 1944 requirements of 4,888,000 barrels. Most of the kerosine sent abroad went to the United Kingdom, and the total of these shipments increased from 4,168,000 barrels in 1944 to 4,984,000 in 1945. Comparative lesser quantities of kerosine were also exported, principally to Canada, Mexico, the Netherlands and to France in 1945. No kerosine was imported into the United States in 1945 and only 147,000 barrels were reported for 1944 compared with 375,000 in 1943.

Stocks of kerosine, which gained in 1944, declined slightly in 1945, when the year-end total of 10,421,000 barrels was approximately 7 percent below the comparative item of 11,150,000 for 1944. The shrinkage of kerosine stocks in 1945 was limited to those held at bulk terminal points, which dropped by 22 percent from 5,385,000 barrels in 1944 to 4,209,000 at the close of 1945. Conversely, supplies of kerosine reported as stored at refineries increased from 5,765,000 barrels in 1944 to 6,212,000 in 1945, a gain of 8 percent. The number of days supply of kerosine stocks on hand at the year end, which incidentally has shown a sharp downward trend in recent years, was arrested slightly in 1944 at 39 days compared with 38 days for 1943; however, it again dropped noticeably in 1945 to quantity sufficient for only 33 days.

Broadly speaking, year-end stocks of kerosine in areas of large consumption, the East coast and the North Central States, showed a pronounced shrinkage in 1945 compared with 1944, while inventories in the heavy producing States, Texas and Louisiana, mounted noticeably. The pattern of stock changes in 1945 indicated a lack of adequate transportation facilities to move supplies from main producing centers to the more important markets; furthermore, it differed from that of 1944, when kerosine-stock increases were recorded for the East Coast and North Central areas, and there was a loss for the principal producing section—the Texas Gulf Coast district. Kerosine inventories in the East Coast, where about 60 percent of this fuel is marketed, declined by 11 percent—from 4,359,000 barrels in 1944 to 3,894,000 at the close of 1945. Furthermore, supplies in the area dropped from 39 percent of the national total in 1944 to a 37-percent share in 1945. Even more pronounced percentage losses in year-end kerosine stocks were recorded for the Appalachian (a 46-percent decline) and the Oklahoma-Kansas-Missouri (a 17-percent loss) refinery districts, and the inventory for the Indiana-Illinois-Kentucky area declined from 2,362,000 barrels in 1944 to 1,769,000 in 1945, a 25-percent shrinkage. The more important gains in kerosine stocks in 1945 were noted for the Texas Gulf district, where there was a 51-percent increase and for the Arkansas-Louisiana Inland district, where supplies mounted by 49 percent. Stock increases for the Texas Inland and Louisiana Gulf areas in 1945 were less pronounced, while losses were registered for relatively unimportant quantities stored in the Rocky Mountain and California refinery districts.

Annual sales of kerosine have remained at a fairly constant level in recent years, however, the total of 71,214,000 barrels shown in the 1944 survey by the Bureau of Mines was 5 percent above 1943 deliveries of 67,815,000 barrels. All sections of the country except the Pacific coast reported nominal gains in sales of kerosine in 1944 compared with 1943. Requirements in the important East Coast area, which registered a sharp decline in 1943 due to the rationing and other difficulties, were reported as 41,458,000 barrels, an increase of 6 percent over the 1943 total of 39,202,000 barrels. An upturn in the quantity of kerosine handled was evident in all parts of the Atlantic Coast market; however, a 7-percent gain indicated for the Middle Atlantic States in 1944 was above the average for the area as a whole. Sales of kerosine in 1944 in the North Central States, another important consuming area, were 7 percent over 1943 deliveries, and a 6-percent gain was also noted in the 1944 deliveries in the South Central States. Relative little kerosine is sold on the Pacific coast, and the 1944 total of 2,454,000 barrels was 15 percent below 1943 requirements.

Sales of kerosine in the United States, 1943–44, by regions, States, and uses [1]

[Thousands of barrels]

Region and State	Sold as range oil		Tractor fuel		All other uses		Total	
	1943	1944	1943	1944	1943	1944	1943	1944
Pacific coast:								
California	61	278	21	22	2,136	1,584	2,218	1,884
Oregon	15	29		2	145	138	160	169
Washington	14	29		1	215	173	229	203
Arizona	7	22			226	159	233	181
Nevada	2	3			52	14	54	17
Rocky Mountain:								
Idaho	3	6	10	13	33	32	46	51
Montana	36	29	58	49	54	64	148	142
Wyoming	13	11	20	24	29	25	62	60
Utah	4	7	6	5	15	15	25	27
Colorado	34	28	49	57	81	97	164	182
New Mexico	60	73	43	38	59	66	162	177
North Central:								
North Dakota	73	71	145	164	77	89	295	324
South Dakota	80	77	154	150	74	85	308	312
Minnesota	312	357	192	144	404	467	908	968
Nebraska	260	226	139	124	200	230	599	580
Iowa	278	302	179	731	593	605	1,050	1,638
Wisconsin	292	277	179	135	482	449	953	861
Illinois	1,862	1,803	314	352	1,487	1,673	3,663	3,828
Indiana	257	260	245	210	1,007	1,070	1,509	1,540
Michigan	352	365	222	188	829	861	1,403	1,414
Ohio	553	480	238	171	600	623	1,391	1,274
Kentucky	131	121	101	103	489	530	721	754
Tennessee	163	285	117	168	695	751	975	1,204
South Central:								
Missouri	573	561	173	170	690	782	1,436	1,513
Kansas	176	140	314	326	345	340	835	806
Texas	851	922	1,183	1,078	2,343	2,521	4,377	4,521
Oklahoma	162	224	242	301	666	662	1,070	1,187
Arkansas	162	330	210	248	586	648	958	1,226
Louisiana	168	166	230	202	824	835	1,222	1,203
Mississippi	77	82	164	160	404	467	645	709
Alabama	154	166	103	119	537	516	794	801
New England:								
Maine	1,311	1,360	4	4	34	43	1,349	1,407
New Hampshire	810	785	1	1	10	9	821	795
Vermont	447	401	2	1	56	52	505	454
Massachusetts	9,920	10,577	2		312	399	10,234	10,976
Rhode Island	1,853	1,967	2	3	57	53	1,912	2,023
Connecticut	3,434	3,530			67	78	3,501	3,608
Middle Atlantic:								
New York	6,286	6,888	86	82	1,059	1,007	7,431	7,977
New Jersey	3,019	3,433	117	75	949	991	4,085	4,499
Pennsylvania	858	1,026	138	108	1,256	1,114	2,252	2,248
Delaware	85	103	1		56	59	142	162
Maryland	660	683	24	19	402	443	1,086	1,145
District of Columbia	96	107	9	1	66	72	171	180
South Atlantic:								
Virginia	224	273	22	21	619	686	865	980
West Virginia	47	36	16	10	116	123	179	169
North Carolina	768	739	91	85	651	659	1,510	1,483
South Carolina	230	275	64	71	460	514	754	860
Georgia	299	394	102	92	525	501	926	987
Florida	689	710	137	115	653	680	1,479	1,505
Total United States	38,221	41,017	5,869	6,143	23,725	24,054	67,815	71,214

[1] Figures for 1945 by States not yet available.

The larger share (56 percent in 1943 and 58 percent in 1944) of kerosine sales is reported as range oil or fuel used for cooking or for water and room heating, and the total under that general classification increased from 38,221,000 barrels in 1943 to 41,017,000 in 1944, a 7-percent gain. Some kerosine (about 9 percent of the total) is consumed as tractor fuel, and the annual sales survey showed that the demand increased by 5 percent from 5,869,000 barrels in 1943 to 6,143,000 in 1944. All other uses of kerosine, 24,054,000 barrels in 1944, was little above 1943 requirements of 23,725,000 barrels.

Sales of range oil in the United States, 1942–44, by States [1]

[Thousands of barrels]

State	1942	1943	1944	
			Total	Percent of total
Massachusetts	11,682	10,251	10,993	23.1
New York	7,128	6,494	7,013	14.7
Connecticut	3,771	3,608	3,918	8.2
New Jersey	3,449	3,085	3,504	7.4
Illinois	2,789	3,281	3,139	6.7
Rhode Island	2,292	1,917	2,042	4.3
Maine	1,627	1,355	1,435	3.0
Michigan	934	1,025	1,101	2.3
Pennsylvania	919	891	1,055	2.2
Iowa	674	878	964	2.0
Texas	558	865	931	2.0
Wisconsin	781	856	864	1.8
Minnesota	663	750	858	1.8
New Hampshire	914	835	808	1.7
North Carolina	785	809	761	1.6
Florida	654	719	735	1.5
Missouri	553	700	727	1.5
Maryland	662	666	690	1.4
Indiana	439	553	582	1.2
Ohio	472	634	562	1.2
Other States	3,177	3,925	4,954	10.4
Total United States	44,923	44,097	47,636	100.0

[1] Figures for 1945 by States not yet available.

There was very little fluctuation in representative kerosine prices in 1945. The quotation on 41°–43° gravity, water-white kerosine at refineries in Oklahoma dropped from 4.38 cents a gallon to an average of 4.31 cents on November 30, and this changed the weighted average for that month to 4.37 cents a gallon. The price was again increased to 4.38 cents a gallon on December 26, resulting in an average of 4.33 cents for the closing month of 1945 and an average of 4.37 cents a gallon for the year compared with 4.38 cents in 1944. The tankwagon price for kerosine at Chicago dropped from 10.6 cents a gallon to 10.3 cents on August 20; however, the higher quotation was restored on November 5, 1945.

FUEL OIL

The domestic demand for fuel oil set a new record in 1945; however, with the cessation of hostilities, exports dropped sharply. An increase of 4 percent in demand for fuel oil on the home market compares with an expansion of 7 percent in 1944 over 1943, while the pronounced shrinkage in the foreign trade is indicated by an 18-percent decline in 1945 in contrast to a 41-percent gain in 1944. It was necessary to draw heavily on stocks in 1945 to satisfy all demands, as a slight increase in production (3 percent over 1944) was not sufficient to offset a 17-percent drop in imports and a 25-percent decline in transfers of crude oil to the fuel-oil account. The indicated domestic demand for fuel oil increased from 721,340,000 barrels in 1944 to 748,835,000 in 1945. The market for the heavier fuel oils showed the greater expansion in 1944—10 percent over 1943 compared with less than a 1-percent gain for the distillate grades—however, this was reversed in 1945, when the demand for the lighter fuel oils of 225,753,000 barrels was 8 percent above the 1944 total of 209,320,000 and the volume for residuals—523,082,000 barrels in 1945—was only 2 percent over 1944 domestic requirements of 512,020,000 barrels. Exports of fuel oil declined from 56,027,000 barrels in 1944 to 45,746,000 in 1945. Foreign shipments of both light and heavy fuel oils were lower in 1945, when the total for distillate grades dropped by 22 percent from 43,491,000 barrels in 1944 to 33,827,000 in 1945, and the overseas demand for residuals (11,919,000 barrels) was 5 percent below 1944 requirements of 12,536,000 barrels. The downward trend in the foreign trade in fuel oils in 1945 compares with a net gain of 41 percent in 1944 over 1943, resulting from a 74-percent rise in exports of light fuel oils and a 16-percent decline for the heavier grades in the same year.

The peak demand for fuel oil was reached in the first quarter of 1945, when requirements of 213,160,000 barrels were 8 percent above the comparative 1944 total of 197,669,000 barrels. Most of this increase was limited to the heavier grades—important fuel in the war effort—of which the quarterly total increased 11 percent from 131,098,000 barrels in 1944 to 144,879,000 in the opening months of 1945, while the first-quarter gain for the distillate fuel oils was less than 3 percent—68,281,000 barrels in 1945 compared with 66,571,000 in 1944. It should be added that warmer weather in the initial months of 1945 was a factor and undoubtedly tended to soften the market for light heating oils.

Salient statistics of fuel oil in the United States, 1944–45

[Thousands of barrels]

	1944			1945 [1]		
	Distillate fuel oil	Residual fuel oil	Total	Distillate fuel oil	Residual fuel oil	Total
Stocks at beginning of year:						
Refinery	27,816	38,855	66,671	25,070	40,356	65,426
Bulk terminal	13,912	9,629	23,541	13,263	10,027	23,290
Production	239,152	461,455	700,607	249,224	469,492	718,716
Transfers from crude oil to fuel oil:						
California	79	23,177	23,256	3	16,039	16,042
East of California	3,163	5,338	8,501	3,044	4,688	7,732
Imports	7,022	36,485	43,507	4,754	31,557	36,311
Exports	43,491	12,536	56,027	33,827	11,919	45,746
Stocks at end of year:						
Refinery	25,070	40,356	65,426	23,842	28,749	52,591
Bulk terminal	13,263	10,027	23,290	11,936	8,409	20,345
Indicated domestic demand:						
Class I railroads, purchases [2]	(3)	(3)	121,194	(3)	(3)	122,777
Public-utility power plants [4]	(3)	(3)	20,866	(3)	(3)	20,183
Bunker oil, foreign trade [5]	(3)	(3)	70,061	(3)	(3)	79,611
All other demands	(3)	(3)	509,219	(3)	(3)	526,264
	209,320	512,020	721,340	225,753	523,082	748,835

[1] Subject to revision.
[2] Interstate Commerce Commission; total includes Diesel fuel.
[3] Figures not available.
[4] Federal Power Commission.
[5] Bureau of the Census, U. S. Department of Commerce, total includes Diesel fuel.

The ending of hostilities in Europe in May and in the Pacific area in August and the resulting cancellation of numerous war contracts, the fading of peak transportation activities, and the slack period for heating oils were all reflected in declining domestic fuel-oil needs in the second and third quarters of 1945 and an actual drop in the fourth-quarter volume of 1945 compared with 1944. The demand in the second quarter of 180,524,000 barrels was 6 percent above the corresponding 1944 item—170,234,000 barrels—and the gain shrank to 4 percent in the third quarter (161,811,000 barrels in 1945 compared with 155,561,000 in 1944), when the heating load was at its lowest ebb. The rising seasonal demand for heating oils in the final quarter of 1945 was not sufficient to offset dwindling military and industrial requirements and the total for the period—193,340,000 barrels—was 2 percent below the comparative 1944 quantity of 197,876,000 barrels.

When the quarterly demands for light and heavy fuel oils are reviewed separately, it is found that the market for distillate grades—important for space heating—tended to maintain a higher relative volume in 1945 than in 1944, while the demand for residual fuel oils—used principally for industrial and transportation fuels—contracted sharply. The requirements for light fuel oils was up 10 percent in the second quarter of 1945 over 1944, 13 percent in the third quarter, and 9 percent in the closing months of the year, while demand for the residual grades slumped steadily as military activities were terminated or from a 6-percent gain in the second quarter of 1945 over the corresponding 1944 total to less than a 1-percent increment in the third quarter and to an actual decline of 7 percent in the closing 3 months of 1945. Colder weather in the final three quarters of 1945 as well as the cancellation of all rationing of oil supplies as of August 15, 1945, were factors that helped to keep the domestic demand for light fuel oils at expanded levels.

Available statistics show that the domestic demand for fuel oil (201,145,000 barrels) in the first quarter of 1946 was 6 percent below the total (213,160,000 barrels) for the comparative period of 1945. The decline in the market, however, was limited to the heavier grades, which dropped by 13 percent from 144,879,000 barrels in the initial quarter of 1945 to 126,527,000 for the same quarter of 1946. Conversely, the requirements for distillate fuel oil during the first 3 months of 1946 (74,618,000 barrels) was 9 percent over the comparative 1945 total of 68,281,000 barrels.

Detailed statistics covering sales of fuel oil by principal uses in 1945 as reported in the annual survey are not ready at this time; however, some estimates based on monthly figures and other data from various sources can be presented. It is evident that the railroads required about 126,800,000 barrels of fuel oil in 1945 compared with 125,162,000 in 1944. Monthly totals compiled by the Interstate Commerce Commission covering purchases of fuel oil by class I railroads for locomotives and rail motor cars show a slight drop for residual grades from 113,314,000 barrels in 1944 to 111,966,000 in 1945, while the Diesel-fuel item was up sharply from 7,880,000 barrels in 1944 to 10,811,000 in 1945. Fuel oil delivered for the bunkering of vessels probably reached 121,000,000 barrels in 1945 compared with 105,256,000 in 1944. Records by the Bureau of the Census, United States Department of Commerce, show that vessels engaged in foreign trade loaded 79,611,000 barrels of bunker oil at continental United States ports in 1945—a gain of 14 percent over the 1944 total of 70,061,000 barrels. It is estimated that bunker-oil requirements for

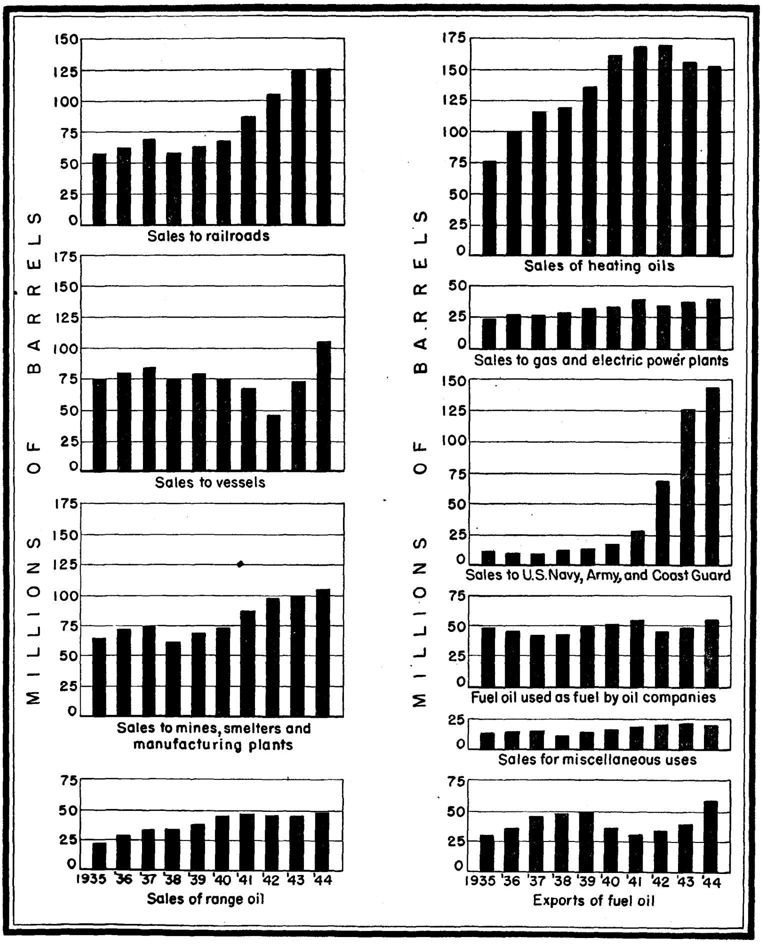

FIGURE 10.—Sales of fuel oil and range oil in the United States, 1935–44, by uses.

vessels operating along the coasts and on inland waterways expanded from approximately 35,000,000 barrels in 1944 to 41,000,000 in 1945.

The consumption of fuel oil by the electric-power and manufactured-gas industries was evidently about 41,500,000 barrels in 1945, a total 3 percent above 1944 requirements of 40,313,000 barrels. Statistics released by the Federal Power Commission indicate 20,183,000 barrels of fuel oil used for the production of electric energy in 1945 (compared with 20,866,000 barrels in 1944), while it is thought that quantities delivered to manufactured-gas companies will approximate 21,300,000 barrels in 1945—a moderate increase over the 1944 quantity of 19,921,000 barrels.

The rationing of fuel oil up to August 15, 1945, and the difficulties of obtaining supplies and equipment probably prevented any expansion in the use of fuel oil by manufacturing industries, and it is estimated that requirements for the year—103,400,000 barrels—were about the same as in 1944. Nearly three-fourths of the fuel oil used for space heating is distillate, and it is estimated that the demand for this grade increased somewhat after the end of rationing to a 1945 total of 122,000,000 barrels, compared with deliveries of 111,729,000 in 1944. Heavy fuel oil used in heating probably rose to 45,500,000 barrels in 1945, advancing the total for all grades to 167,500,000 barrels against 152,203,000 in 1944. It is believed that No. 1 fuel oil consumed as range oil totaled about 7,800,000 barrels in 1945, compared with 6,619,000 in 1944.

Sales of fuel oil [1] and of range oil in the United States, 1940–44 by uses [2]

[Thousands of barrels]

Use	1940	1941	1942	1943	1944
Fuel oil:					
Railroads	68,098	85,510	106,484	124,886	125,162
Ships' bunkers (including tankers)	74,803	67,635	46,717	73,265	105,256
Gas and electric power plants	32,795	38,774	33,805	36,812	40,313
Smelters, mines, and manufacturing industries	73,940	88,387	97,132	99,344	103,617
Heating oils	160,379	167,514	168,989	155,251	152,203
Fuel oil (No. 1) sold as range oil	3,977	4,449	4,978	5,876	6,619
U. S. Navy, Army, and Coast Guard	17,183	28,739	67,800	126,096	144,226
Oil-company fuel	51,928	55,297	45,935	48,007	56,344
Miscellaneous uses	15,655	18,024	20,306	20,652	19,544
Total United States	498,758	554,329	592,146	[3] 690,189	[3] 753,284
Exports and shipments to noncontiguous Territories	35,249	31,039	33,670	39,851	56,027
Total	534,007	585,368	625,816	730,040	809,311
Range oil	44,692	46,110	44,923	44,097	47,636

[1] Includes distillate fuel oil, residual fuel oil, and some crude oil burned as fuel.
[2] Figures for 1945 not yet available.
[3] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

Sales of distillate fuel oil [1] in the United States, 1940–44, by uses [2]

[Thousands of barrels]

Use	1940	1941	1942	1943	1944
Railroads	3,194	4,945	6,488	8,608	10,627
Ships' bunkers (including tankers)	13,249	10,957	8,900	11,069	13,187
Gas and electric power plants	4,561	5,152	5,704	5,954	5,837
Smelters, mines, and manufacturing industries	7,330	10,363	12,617	15,125	16,953
Heating oils	115,533	120,908	121,506	112,581	111,729
Fuel oil (No. 1) sold as range oil	3,977	4,449	4,978	5,876	6,619
U. S. Navy, Army, and Coast Guard	1,402	2,993	11,269	33,383	42,879
Oil-company fuel	1,064	1,116	1,064	884	981
Miscellaneous uses	10,342	12,456	14,287	14,232	15,060
Total United States	160,652	173,339	186,813	207,712	[3] 223,872
Exports and shipments to noncontiguous Territories	19,140	16,925	21,575	24,957	43,491
Total	179,792	190,264	208,388	232,669	267,363

[1] Includes Diesel fuel.
[2] Figures for 1945 not yet available.
[3] This total involve some duplication due to rehandling of fuel oil initially sold to the Government

Oil companies produced and refined slightly more crude petroleum in 1945 than in 1944 and therefore probably used additional fuel oil in their operations— about 57,500,000 barrels compared with 56,344,000 in 1944. The balance of the fuel oil available in 1945—about 123,000,000 barrels—must be credited to military and miscellaneous uses.

Sales of residual fuel oil [1] *in the United States, 1940–44, by uses* [2]

[Thousands of barrels]

Use	1940	1941	1942	1943	1944
Railroads	64, 904	80, 565	99, 996	116, 278	114, 535
Ships' bunkers (including tankers)	61, 554	56, 678	37, 817	62, 196	92, 069
Gas and electric power plants	28, 234	33, 622	28, 101	30, 858	34, 476
Smelters, mines, and manufacturing industries	66, 610	78, 024	84, 515	84, 219	86, 664
Heating oils	44, 846	46, 606	47, 483	42, 670	40, 474
U. S. Navy, Army and Coast Guard	15, 781	25, 746	56, 531	92, 713	101, 347
Oil-company fuel	50, 864	54, 181	44, 871	47, 123	55, 363
Miscellaneous uses	5, 313	5, 568	6, 019	6, 420	4, 484
Total United States	338, 106	380, 990	405, 333	[3] 482, 477	[3] 529, 412
Exports and shipments to noncontiguous Territories	16, 109	14, 114	12, 095	14, 894	12, 536
Total	354, 215	395, 104	417, 428	497, 371	541, 948

[1] Includes Navy grade and crude oil burned as fuel.
[2] Figures for 1945 not yet available.
[3] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

The trend in the demand for fuel oil for different uses during the years 1935–44 as reported to the Bureau in the annual survey of sales is indicated by a series of columns in figure 10. Light and heavy fuel oils as well as kerosine sold as range oil, are included.

Fuel-oil exports (including shipments to noncontiguous Territories) declined by 18 percent from 56,027,000 barrels in 1944 to 45,746,000 in 1945. Exports of distillate fuel oil were unusually high in 1944 due to lend-lease requirements, however, this demand was not repeated in 1945, when the total of 33,827,000 barrels was 22 percent below the 1944 volume of 43,491,000 barrels. It should be added, however, that the 1945 export total for distillate fuel oil was still above the prewar level of these shipments. Export of residual fuel oil have not varied greatly during the war years—the 1945 total of 11,919,000 barrels was 5 percent below the 1944 item of 12,536,000 barrels.

Virtually all the loss in exports of distillate fuel oil in 1945 is found in the lower shipments to the United Kingdom, which declined from 37,640,000 barrels in 1944 to 26,913,000 in 1945. The Canadian demand for American light fuel oil also dropped from 1,714,000 barrels in 1944 to 826,000 in 1945. Conversely, exports of distillate to U. S. S. R. continued to show an upward trend, from 264,000 barrels in 1943 to 312,000 in 1944 and to 1,052,000 in 1945.

Lend-lease shipments of heavy fuel oil to the United Kingdom declined from 6,059,000 barrels in 1944 to 4,360,000 in 1945, while exports to Canada, which have dropped in the 2 previous years, turned upward in 1945 to 734,000 barrels compared with requirements of 496,000 in 1944. Greatly expanded movements of heavy fuel oil to Cuba reported in 1944—2,245,000 barrels—were not repeated in 1945, as the total shipped to that country, mostly for reexport, declined to 1,005,000 barrels. Relatively important quantities of residual fuel oil are sent to Mexico; however, the volume for 1945—583,000 barrels—was below the 1944 item of 627,000 barrels. A small quantity of heavy fuel oil was credited to U. S. S. R. in 1945—159,000 barrels—and none in 1944.

The production of fuel oil rose from 700,607,000 barrels in 1944 to 718,716,000 in 1945—an increase of less than 3 percent compared with gains of 13 percent realized in 1943 and 11 percent in 1944.

The output of distillate fuel oil expanded from 239,152,000 barrels in 1944 to 249,224,000 in 1945—a gain of over 4 percent—while the increment for residual grades was less than 2 percent—469,492,000 barrels in 1945 compared with 461,455,000 in 1944. In 1944 and 1945 the larger production of fuel oil as a whole must be attributed solely to the greater volume of crude runs, as the percentage yield dropped from 44.0 percent in 1943 to 42.1 percent in 1944 and then to 41.8 percent in 1945. This shrinkage in the yield of fuel oil resulted largely from the effort of refiners to produce a maximum quantity of gasoline (straight-run and cracked), and this is reflected in the rising percentage yield of the latter product, which has increased from about 37 percent in 1943 to nearly 41 percent in 1945. In other words, some potential production of fuel oil was sacrificed to make more gasoline—a product greatly needed in the war as well as a more profitable one. The refining program had a greater effect on the output of residual grades of fuel oil, the percentage yield of which declined from 29.2 percent in 1943 to 27.3 percent in 1945; and the gain in production of 16 percent realized in 1943 dropped to an 11-percent increment for 1944 and to less than a 2-percent increase in 1945, while the yield of light fuel oils was maintained at an average of 14.5 percent for the same years and the annual increases in production (8 percent for 1943, 13 percent for 1944, and over 4 percent for 1945) have not fallen so drastically as for the residual grades.

Variations in fuel-oil production in the several refinery districts in 1945 compared with 1944 can be attributed to both fluctuations in crude runs and modified percentage yields. In the Atlantic Coast district, where about one-fifth of the fuel oil of the country is produced, the output of both distillate (50,243,000 barrels in 1945 compared with 46,763,000 in 1944) and residual (85,352,000 barrels in 1945 compared with 79,964,000 in 1944) expanded by about 7 percent in 1945. The gain in production for the area in 1945 was mostly due to higher crude runs (7 percent over 1944), as the percentage yields for both light and heavy fuel oils were only fractionally higher than in 1944. The foreign crude refined on the Atlantic coast usually has a high residual fuel-oil content, and the volume of this crude processed in 1945 (71 percent over 1944) was also a factor in the increased output of heavy fuel oil.

About 30 percent of all distillate and 20 percent of the heavy fuel oil is produced in the Texas Gulf Coast district. The output of residual there declined by 9 percent from 97,683,000 barrels in 1944 to 88,617,000 in 1945—a loss resulting not only from smaller crude runs but also from a considerably lower yield, which declined from 23.9 percent in 1944 to 22.0 percent in 1945, a downward change caused by the higher production of gasoline in the area. The percentage yield of distillate was up fractionally (18.3 percent in 1945 compared with 18.1 percent in 1944), so even with the smaller quantity of crude petroleum run to stills the production of 73,677,000 barrels in 1945 differed little from the 1944 total of 73,935,000 barrels.

A very large volume of residual fuel oil—about one-third of the national total—is produced in the Pacific Coast area, and the quantity increased by nearly 10 percent from 135,946,000 barrels in 1944 to 148,976,000 in 1945. The gain in the residual output on the Pacific coast in 1945 was not only due to expanded runs (6 percent over 1944), but also to the kind of crude processed—a heavy petroleum which yielded 47.5 percent of heavy fuel oil in 1945 compared with 46.1 percent in 1944. It should be added that this larger quantity of residual fuel oil was made in 1945, even though the production and percentage yield of gasoline were also increased. The distillate fuel-oil content of California crude is fairly low (10.0 percent yield in 1944 and 9.5 percent in 1945); and the production of 29,702,000 barrels in 1945 was only 1 percent over the 1944 total of 29,382,000 even though runs were higher in 1945.

Sales of fuel oil [1] in the United States, 1940–44, by regions and States [2]

[Thousands of barrels]

Region and State	1940	1941	1942	1943	1944
Pacific coast:					
Washington	9,688	12,199	16,029	18,645	18,829
Oregon	11,089	12,562	15,577	18,808	18,565
California	71,516	77,201	99,839	136,400	134,159
Arizona	3,693	4,431	4,819	4,891	3,783
Nevada	3,418	4,286	6,057	7,522	8,222
Rocky Mountain:					
Idaho	565	750	1,080	1,036	1,149
Montana	2,077	3,220	3,894	4,336	6,449
Wyoming	2,012	2,262	2,613	2,880	6,071
Utah	603	692	995	1,374	1,773
Colorado	1,097	1,474	1,794	2,145	2,504
New Mexico	630	701	779	998	1,277
North Central:					
North Dakota	647	677	703	643	586
South Dakota	891	909	904	860	844
Minnesota	6,939	7,309	7,737	7,037	6,509
Nebraska	2,721	2,766	2,781	2,658	3,117
Iowa	3,449	3,998	4,724	4,744	4,441
Wisconsin	6,885	7,344	7,497	7,239	6,792
Illinois	26,182	28,943	30,724	30,871	31,596
Indiana	9,965	12,782	12,178	12,024	14,703
Michigan	11,967	13,584	14,917	14,056	13,041
Ohio	9,084	10,970	12,373	13,567	14,483
Kentucky	1,355	1,697	2,154	2,273	2,089
Tennessee	1,045	1,263	1,549	2,177	2,748
South Central:					
Missouri	10,404	10,948	11,219	11,544	10,930
Kansas	8,162	9,277	9,046	12,638	12,369
Texas	43,222	51,634	63,449	94,220	103,046
Oklahoma	8,544	9,303	9,332	10,377	9,449
Arkansas	2,562	3,136	3,511	4,321	4,262
Louisiana	11,810	17,151	13,864	17,196	18,964
Mississippi	619	999	812	1,046	1,245
Alabama	1,976	2,780	3,313	3,752	3,843
New England:					
Maine	3,040	3,892	3,331	2,816	3,073
New Hampshire	2,153	2,565	2,043	1,371	1,521
Vermont	803	901	813	633	682
Massachusetts	26,857	29,996	25,703	22,738	27,055
Rhode Island	8,839	9,594	7,835	5,545	6,448
Connecticut	10,675	11,358	10,355	9,566	10,136
Middle Atlantic:					
New York	54,520	56,780	54,128	56,665	53,405
New Jersey	49,578	47,904	47,972	55,128	81,678
Pennsylvania	29,269	31,479	31,249	34,740	45,454
Delaware	1,717	1,803	1,814	1,984	1,682
Maryland	12,286	13,436	13,321	14,649	16,313
District of Columbia	2,986	3,459	3,317	2,859	2,545
South Atlantic:					
Virginia	4,794	4,462	4,388	7,550	10,178
West Virginia	1,128	1,261	1,283	1,635	1,294
North Carolina	1,112	1,384	1,641	1,727	1,636
South Carolina	1,253	1,404	1,652	1,494	1,953
Georgia	2,418	2,958	2,851	3,402	3,766
Florida	10,513	12,445	12,187	13,409	16,627
Total United States	498,758	554,329	592,146	[3] 690,189	[3] 753,284

[1] Includes distillate fuel oil, residual fuel oil, and some crude oil burned as fuel.
[2] Figures for 1945 not yet available.
[3] These totals involve some duplication due to rehandling of fuel oil initially sold to the Government.

The Indiana-Illinois-Kentucky refinery district is a fairly important source of both light and heavy fuel oil. The refineries in the area not only ran slightly less crude petroleum in 1945 than in 1944, but they also reduced the percentage yield of residual to turn out more gasoline. The result was that the output of heavy fuel oil dropped by 6 percent—from 56,890,000 barrels in 1944 to 53,494,000 in 1945. However, there was little change in the production of light fuel oil—34,601,000 barrels in 1945 compared with 34,544,000 in 1944—even considering the lower runs—as the yield of this lighter product—12.4 percent in 1944 and 12.5 percent in 1945—was slightly improved.

Refiners operating in the Oklahoma-Kansas-Missouri district ran about 5 percent more crude in 1945 than in 1944; and with only minor changes in the percentage yields for fuel oils, they were enabled to increase the output of distillate by 6 percent from 19,281,000 barrels in 1944 to 20,500,000 in 1945, while the production of the heavier grades—24,764,000 barrels in 1945 compared with 23,984,000 in 1944—represented an expansion of 3 percent. These higher outputs of fuel oil in 1945 apparently did not affect the production of gasoline, as that priority product also showed a gain both in volume and percentage yield.

An 18-percent increase in the volume of crude petroleum refined in the Louisiana Gulf Coast area and a higher yield (19.8 percent in 1945 compared with 18.4 percent in 1944) for distillates resulted in a 27-percent gain in the output for these light fuel oils—19,710,000 barrels in 1945 against 15,572,000 in 1944. However, the yield for heavier grades was cut rather drastically (17.2 percent in 1945 compared with 19.3 percent in 1944) to make more gasoline; as a result, the production of 17,062,000 barrels in 1945 was only about 5 percent over the 1944 total of 16,322,000, even though the runs were much higher in 1945.

Relatively smaller quantities of distillate fuel oil are produced in the remaining refinery districts. Gains in the output for 1945 were reported for the Texas Inland and Rocky Mountain areas owing to increased runs and higher percentage yields, while conversely the lower production of light fuel oils in the Appalachian and Arkansas and Louisiana Inland districts was the result of opposite operating conditions—reduced runs and scaled-down yields. The Texas Inland area produces an appreciable amount of heavy fuel oil (about 5 percent of the national total); however, although runs were greater, the volume of this grade of fuel oil dropped by 6 percent, as the percentage yield was cut heavily from 28.8 percent in 1944 to 26.6 percent in 1945. The Rocky Mountain refinery district produced 18 percent more residual fuel oil in 1945 than in 1944, as both the runs and the percentage yield were substantially higher in 1945. Small quantities of heavy fuel oil originate in the Appalachian and Arkansas and Louisiana Inland districts, and the respective totals for 1945 were nominally lower than those for 1944.

Crude oil is sometimes used directly as fuel, and when so used it is credited to the fuel-oil account and appears in fuel-oil statistics under the general heading of "transfers." Light crude oil consumed as fuel by pipe line companies is transferred to the distillate fuel-oil total, while heavy crude petroleum used directly as fuel on leases or for

717372—47——72

general industrial purposes is covered in transfers as part of the residual fuel-oil supply.

Transfers classed as distillate fuel oil decreased from 3,242,000 barrels in 1944 to 3,047,000 in 1945, and the quantities for both years represented only about 1 percent of the total light fuel-oil supply for all purposes. Transfers to the residual fuel-oil supply, which have increased steadily in volume during the war years, declined by 27 percent from 28,515,000 barrels in 1944 to 20,727,000 in 1945; and incidentally, the total in 1945 represented less than 4 percent of the heavy fuel-oil supply for all uses compared with over a 5-percent share in 1944. Most of the residual transfers are reported from California, and there the quantity declined from 23,177,000 barrels in 1944 to 16,039,000 in 1945—a 31-percent shrinkage. This drop in transfers to the residual fuel-oil account in California was undoubtedly due in part to a lower production of nongasoline-bearing crude in that area in 1945. Transfers to residual fuel oils east of California of 4,688,000 barrels in 1945 were about 13 percent below the 1944 total of 5,338,000 barrels.

Very little light crude oil is credited to the distillate fuel-oil account in California, and the quantity has ranged from 19,000 barrels in 1943 to 79,000 in 1944 and then down to 3,000 in 1945. Light crude oil added to distillate fuel oils in areas east of California totaled 3,044,000 barrels in 1945 compared with 3,163,000 in 1944.

The high imports of fuel oil recorded in 1943 and 1944 were not repeated in 1945, when total receipts from foreign sources—36,311,000 barrels—were about 17 percent below the 1944 level (43,507,000 barrels). Furthermore, imported fuel oil supplied only about 5 percent of the demand for all purposes in 1945 compared with a 6-percent share in 1944. The drop in imports of residual grades from 36,485,000 barrels in 1944 to 31,557,000 in 1945 (a 14-percent shrinkage) was not as pronounced as that for the light fuel oils, which declined by a third from 7,022,000 barrels in 1944 to 4,754,000 in 1945. Several factors, such as an increased percentage yield, greater percentage increase in production, a relative lower drop in transfers, greatly curtailed exports, and a relatively favorable stock position resulted in a better supply situation for distillate fuel oils in 1945; consequently, there was not a great pressure for imports. However, in the case of residual grades, all the above-mentioned factors were statistically less favorable in 1945, and therefore, there was an incentive to maintain imports at a relatively high level to satisfy the market. Imports supplied less than 2 percent of all demands for distillate fuel oil in 1945, compared with a 3-percent share in 1944, while the percentage of residual fuel oil of foreign origin in the marketed total was 7 percent in 1944 and 6 percent in 1945.

Most of the fuel oil imported into the United States is credited to Curacao, a refining center on an island in the Netherlands West Indies, which runs on crude from Venezuelan fields. Less important quantities are also received from Venezuela, Trinidad, Mexico, and Canada.

An improved fuel-oil stock situation evident in 1944 was not repeated in 1945, when the year-end total (72,936,000 barrels), was about 18 percent below the comparative 1944 item (88,716,000 barrels). The heavy fuel-oil inventory showed some improvement in 1944 (4 percent over 1943); however, it declined sharply in 1945 to 37,158,000 barrels, a total 26 percent below 1944 year-end stocks of 50,383,000 barrels. Distillate fuel oils held in storage totaled 35,778,000 barrels at the close of 1945 compared with 38,333,000 for 1944—a drop of about 7 percent and a percentage decline similar to those reported for 1944 and 1943.

The heavy liquidation of residual fuel-oil stocks in 1945 was due to a combination of several factors. The percentage yield was lowered in 1945 to make more gasoline, with the result that production of heavy fuel oils showed only a slight gain (less than 2 percent) even though crude runs were increased over 3 percent. Furthermore, additional supplies of residual fuel oil from both "transfers" and imports were down sharply in 1945, compared with 1944, and hence there was added pressure to force large quantities from storage. Exports showed a small decline (5 percent) in 1945; however, there was an active domestic demand, and consequently a large volume of heavy fuel oil from inventory was diverted to the market. The same factors influencing the flow of distillate fuel oil into consumption were statistically more favorable, and therefore the draft on stocks was less critical in 1945 than for the heavy grades.

Fuel oil held in storage at refineries dropped 20 percent—from 65,426,000 barrels in 1944 to 52,591,000 at the end of 1945—and compared with a 2-percent shrinkage in 1944 over 1943. The liquidation of fuel oils held at bulk storage plants was less pronounced; however, there was a decline of about 13 percent (20,345,000 barrels at the end of 1945 against 23,290,000 in 1944) compared with a drop of only 1 percent in 1944. Residual fuel oils stored at refineries (28,749,000 barrels at the end of 1945) were 29 percent below the comparative 1944 total of 40,356,000; this loss is in contrast to a gain of 4 percent for these stocks reported in 1944. The heavy-fuel-oil inventory at bulk terminals (8,409,000 barrels at the end of 1945) was 16 percent below the 1944 total (10,027,000 barrels). This shrinkage in volume of residual fuel oil stored at bulk plants in 1945 compares with a 4-percent gain realized in 1944. The quantity of distillate fuel oil carried at refineries has continued to drop since 1941, although at a diminishing percentage rate of decline for each year. The year-end total for 1945 (23,842,000 barrels) was 5 percent below the 1944 quantity (25,070,000 barrels), which in turn was 10 percent less than the comparative 1943 item. Light fuel oil held at bulk plants at the close of 1945 (11,936,000 barrels) was 10 percent less than the 1944 inventory (13,263,000 barrels) and compares with a loss of 5 percent reported for 1944 and a gain of 13 percent in 1943 over 1942.

Distillate fuel oil withdrawn from storage satisfied about 1 percent of the total domestic and export demand for both 1944 and 1945, while in the case of residual grades over 2 percent of total requirements came from inventory in 1945 in contrast to none in 1944. Light fuel oil in storage at the end of 1945 represented a 39-day supply at the December daily rate of domestic demand and compares with stock reserves of 47 days at the close of 1944 and 59 days for 1943. The final 1945 inventory for residual fuel oil was adequate for 25 days at the then current rate of domestic demand and contrasts with a 31-day supply represented by year-end heavy-oil stocks of 1944 and 33 days for 1943.

Comparative analyses of statistics for distillate fuel oil in the United States, 1944–45, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers[1] East of California		Transfers[1] California		Imports		Exports		Domestic demand		Stocks	
	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]
By months:																
January	19,344	20,556	14.5	14.2	265	292	16		1,322	6	1,640	2,467	24,145	25,025	36,890	31,695
February	18,454	20,267	14.5	15.0	263	241	4		600	218	2,494	1,755	20,156	23,456	33,561	27,210
March	19,863	20,934	14.4	14.3	275	266	2		798	649	2,303	2,530	22,270	19,800	29,926	26,729
April	19,604	20,443	14.8	14.3	259	253	4		599	758	4,184	3,381	16,056	15,654	30,152	29,148
May	21,215	21,941	15.2	14.4	257	259	2		853	647	4,077	4,217	15,918	18,267	32,484	29,511
June	20,028	21,891	14.3	14.6	246	257	7		447	417	5,534	4,917	12,436	14,719	35,242	32,440
July	21,316	22,099	14.9	14.3	266	273	7		468	192	5,457	3,375	13,507	15,353	38,335	36,276
August	20,593	21,740	14.4	14.2	262	255	5		392	264	5,770	2,292	13,105	14,998	40,712	41,245
September	19,110	19,204	13.6	15.0	265	231			199	217	3,869	1,631	12,730	14,207	43,687	45,059
October	21,697	19,009	15.1	14.5	270	223	4		228	239	3,697	2,505	14,837	16,546	47,352	45,479
November	18,870	19,964	13.5	14.4	264	249	28		335	596	2,371	2,624	18,894	19,102	45,584	44,562
December	19,058	21,176	13.1	14.9	271	245		3	781	551	2,095	2,133	25,266	28,626	38,333	35,778
Total United States	239,152	249,224	14.4	14.5	3,163	3,044	79	3	7,022	4,754	43,491	33,827	209,320	225,753	38,333	35,778
By districts:																
East Coast	46,763	50,243	18.2	18.4											9,621	10,515
Appalachian	6,313	6,101	11.2	10.9											734	745
Indiana, Illinois, Kentucky, etc	34,544	34,601	12.4	12.5	559	480									6,419	5,773
Oklahoma, Kansas, and Missouri	19,281	20,500	14.5	14.7	928	899									2,132	1,839
Texas Inland	5,303	6,146	6.4	7.3	917	924			(3)	(3)	(3)	(3)	(3)	(3)	374	362
Texas Gulf Coast	73,935	73,677	18.1	18.3	375	364									7,549	6,027
Louisiana Gulf Coast	15,572	19,710	18.4	19.8	131	131									1,292	1,766
Arkansas and Louisiana Inland	3,726	3,409	13.3	12.2	43	44									597	469
Rocky Mountain	4,333	5,135	10.5	11.2	210	202									356	414
California	29,382	29,702	10.0	9.5			79	3							9,259	7,868
Total United States	239,152	249,224	14.4	14.5	3,163	3,044	79	3	7,022	4,754	43,491	33,827	209,320	225,753	38,333	35,778

[1] Figures represent crude oil used as fuel on pipe lines.
[2] Subject to revision.
[3] Figures not available.

Distillate fuel-oil stocks reported for the east coast increased by 9 percent from 9,621,000 barrels at the end of 1944 to 10,515,000 for 1945. The 1945 quantity represented 29 percent of the national inventory and compared with a 25-percent share in 1944. Residual fuel-oil stocks in the same area increased by 3 percent—from 6,831,000 barrels in 1944 to 7,057,000 in December 1945. The 1945 quantity was second in volume only to supplies held in California, covered 19 percent of total heavy fuel-oil stocks, and was in contrast to a 14-percent share reported on the Atlantic coast at the end of 1944.

Approximately half of the residual fuel-oil stocks of the country are carried in the California refinery area; however, the proportion declined from nearly 52 percent of the national total in 1944 to 48 percent in 1945. The year-end total for California dropped by 32 percent from 26,047,000 barrels in 1944 to 17,832,000 in 1945 and reflects the tightness of supplies in that area in the latter year. The California refinery district rates second only to the East Coast as a storage area for distillate fuel oils; however, inventories there declined from 24 percent of the national total in 1944 to 22 percent in 1945, and the volume at the end of 1945 of 7,868,000 barrels was 15 percent below comparative 1944 stocks of 9,259,000 barrels.

Important quantities of fuel oil are stored on the Texas Gulf coast; however, the total dropped 37 percent from 17,523,000 barrels in 1944 to 11,078,000 in December 1945. The larger share of this shrinkage was confined to the residual grades, which declined by nearly half from 9,974,000 barrels in 1944 to 5,051,000 at the close of 1945. This heavy draft on residual fuel-oil stocks in that area in 1945 was due to several factors, such as lower runs to stills and a reduced yield, which cut down production by nearly 10 percent. This tightness in the supply in 1945 came at a time of an active market; consequently, unusual liquidation of stocks resulted. Although production of distillate fuel oil was sustained in the Texas Gulf coast in 1945, the heavy demand for supplies lowered stocks 20 percent from 7,549,000 barrels in 1944 to 6,027,000 by the end of 1945.

The fuel-oil inventory in the Indiana-Illinois-Kentucky refinery district was reduced from 9,479,000 barrels in 1944 to 8,360,000 at the end of 1945. Light fuel-oil stocks were lower by 10 percent, from 6,419,000 barrels in 1944 to 5,773,000 in December 1945, as production from reduced crude runs in 1945 was not sufficient to meet requirements. The supply of residual fuel oil in the area was similarly affected; as a result, quantities held in storage were liquidated by 16 percent—from 3,060,000 barrels in 1944 to 2,587,000 at the end of 1945.

Fuel-oil stocks reported in the remaining refinery districts are relatively unimportant. Quantities of distillate stored in the Appalachian, Louisiana Gulf Coast, and Rocky Mountain districts gained in 1945 over 1944. The most important increase was in the Louisiana Gulf area, where the light fuel-oil inventory increased from 1,292,000 barrels in 1944 to 1,766,000 in December 1945. Lower distillate fuel-oil stocks were reported for the Oklahoma-Kansas-Missouri, Texas Inland, and Arkansas and Louisiana Inland refinery districts at the close of 1945 compared with 1944. The 1945 liquidation of light fuel-oil stock was trivial in the Texas Inland area; however, it amounted to a 14-percent reduction for the Oklahoma-Kansas-Missouri district

Comparative analyses of statistics for residual fuel oil in the United States, 1944–45, by months and districts

[Thousands of barrels]

Month and district	Production		Yield (percent)		Transfers[1] East of California		Transfers[1] California		Imports		Exports		Domestic demand		Stocks	
	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]	1944	1945[2]
By months:																
January	38,519	41,862	28.9	28.9	518	448	2,537	1,873	2,523	2,773	710	1,016	45,601	51,976	46,270	44,347
February	36,493	37,141	28.7	27.5	501	390	1,669	1,171	2,822	2,247	833	594	41,852	44,942	45,070	39,760
March	39,738	39,471	28.8	27.0	460	432	2,012	1,362	3,103	3,862	1,311	1,475	43,645	47,961	45,427	35,451
April	37,281	38,660	28.2	27.0	421	395	1,972	1,369	3,856	3,249	726	1,026	44,094	43,680	44,137	34,418
May	38,026	41,569	27.3	27.3	419	408	1,850	1,514	4,035	2,808	1,677	1,331	42,108	45,053	44,682	34,333
June	37,902	40,527	27.1	27.1	389	382	1,681	1,506	3,477	3,184	1,860	1,175	39,622	43,151	46,649	35,606
July	38,332	41,881	26.7	27.0	384	366	1,894	1,538	3,685	2,011	1,228	1,627	39,127	41,434	50,589	38,341
August	37,291	41,200	26.1	27.0	434	398	1,666	1,689	2,950	1,894	611	945	38,813	40,350	53,506	42,227
September	37,903	34,183	27.0	26.7	426	357	1,720	827	3,269	1,257	696	560	38,279	35,469	57,849	42,822
October	39,322	36,452	27.4	27.7	476	411	2,179	1,310	2,276	2,490	713	790	43,969	40,627	57,420	42,068
November	39,370	37,937	28.1	27.4	440	312	2,024	902	2,269	3,395	1,399	579	44,481	42,713	55,643	41,322
December	41,278	38,609	28.4	27.2	470	389	1,973	978	2,220	2,387	772	801	50,429	45,726	50,383	37,158
Total United States	461,455	469,492	27.7	27.3	5,338	4,688	23,177	16,039	36,485	31,557	12,536	11,919	512,020	523,082	50,383	37,158
By districts:																
East Coast	79,964	85,352	31.1	31.2	-------	-------	-------	-------							6,831	7,057
Appalachian	9,194	9,152	16.3	16.3	-------	-------	-------	-------							598	467
Indiana, Illinois, Kentucky, etc.	56,890	53,494	20.4	19.4	614	585	-------	-------							3,060	2,587
Oklahoma, Kansas, and Missouri	23,984	24,764	18.0	17.8	310	269	-------	-------							1,352	1,024
Texas Inland	23,792	22,491	28.8	26.6	1,130	837	-------	-------							727	687
Texas Gulf Coast	97,683	88,617	23.9	22.0	585	751	-------	-------	(3)	(3)	(3)	(3)	(3)	(3)	9,974	5,051
Louisiana Gulf Coast	16,322	17,062	19.3	17.2	1,010	991	-------	-------							1,098	1,458
Arkansas and Louisiana Inland	6,447	6,331	23.0	22.7	759	672	-------	-------							185	270
Rocky Mountain	11,233	13,253	27.2	28.8	930	583	-------	-------							511	725
California	135,946	148,976	46.1	47.5	-------	-------	23,177	16,039							26,047	17,832
Total United States	461,455	469,492	27.7	27.3	5,338	4,688	23,177	16,039	36,485	31,557	12,536	11,919	512,020	523,082	50,383	37,158

[1] Represents quantities used on leases and for general industrial purposes.
[2] Subject to revision.
[3] Figures not available.

and a 21-percent decline for the Arkansas-Louisiana Inland area. Relative important percentage gains in heavy fuel-oil stocks were realized in the Louisiana Gulf, Arkansas and Louisiana Inland, and Rocky Mountain refinery districts in 1945 over 1944, while inventory losses were indicated for the same period in the Appalachian, Oklahoma-Kansas-Missouri, and Texas Inland areas.

During 1945 there were no tanker movements of fuel oil from California to eastern markets. The California refinery district (California, Oregon, Washington, Arizona, and Nevada), however, does make some fuel-oil shipments to other Western States by railroad tank car and trucks. Distillate fuel oil handled in these land movements totaled 636,000 barrels in 1945 compared with 492,000 in 1944, while the quantity of residual grades involved declined from 182,000 barrels in 1944 to 158,000 in 1945. The California refinery area in turn receives some small amounts of fuel oil from other States, namely, 251,000 barrels of light fuel oils in 1945, compared with 275,000 in 1944 and 773,000 barrels of heavy grades in 1945 against 571,000 in 1944.

With the ending of the war in late 1945, the tanker and barge movement of fuel oils from the Gulf refinery districts to the East Coast area showed great improvement, although the traffic is still well below normal volume. Light fuel oils handled over this water route more than doubled—from 13,123,000 barrels in 1944 to 28,175,000 in 1945, yet this latter quantity is much less than the 1941 total of 42,-620,000 barrels. Most of the distillate fuel oil shipped out of the Gulf Coast area to eastern markets is credited to Texas—11,976,000 barrels in 1944 and 24,883,000 in 1945. The balance—1,147,000 barrels in 1944 and 3,292,000 in 1945—originated in Louisiana. Tanker movements of heavy fuel oils over the Gulf-East Coast route increased from 20,453,000 barrels in 1944 to 37,193,000 in 1945. It should be added that the 1945 volume for residuals was only about one-half the comparative 1941 item of 75,923,000 barrels. Texas supplied 18,927,000 barrels of the 1944 quantity and 34,409,000 barrels in 1945. Louisiana furnished the balance of the heavy fuel oil making up this traffic—1,526,000 barrels in 1944 and 2,784,000 in 1945.

The Gulf Coast region makes some barge shipments of fuel oil to points on the Mississippi River. The quantity of distillate fuel oil involved in this movement increased from 2,881,000 barrels in 1944 to 4,352,000 in 1945, while residual grades declined slightly—from 1,182,000 barrels in 1944 to 1,042,000 in 1945. Practically all the fuel oil handled in this barge movement is credited to Louisiana; very little of it comes from Texas. In addition to the above-mentioned quantities, Arkansas also ships fuel oil by barge to Mississippi River ports. All of the oil moved was distillate grade and declined from 3,398,000 barrels in 1944 to 2,980,000 in 1945.

The reporting of rail shipments of petroleum products to the Joint Tank Car Subcommittee was discontinued after August 31, 1945. Available records for the first 8 months of 1945 indicate, however, a pronounced drop in the movement of fuel oils for civilian consumption by rail from districts 2 and 3 into the East Coast area (district 1). Tank-car shipments of distillate fuel oil from district 2 to district 1 declined from 10,614,000 barrels for 1944 to 6,203,000 in the January-August period of 1945, while the total from district 3 into the East

Coast dropped from 18,300,000 barrels in 1944 to 9,078,000 in the first 8 months of 1945. Heavy grades of fuel oil entering district 1 by tank car and credited to district 2 totaled 4,150,000 barrels through August 1945 compared with 8,418,000 in all of 1944. Rail shipments of the same grades from district 3 into the Atlantic Coast area were 43,554,000 barrels in 1944 and 12,251,000 through August 1945. The revival of the tanker traffic between Gulf and East Coast ports and the diverting of railroad tank cars from eastern to western areas to relieve a serious shortage of petroleum products in the Pacific Northwest were the two main factors which adversely affected the rail movement of fuel oils into district 1.

Monthly average prices of kerosine and fuel oils in the United States, 1944–45 [1]

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1944													
41°–43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38
Kerosine, tank-wagon at Chicago cents per gallon	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.60
No. 2 straw fuel oil at refineries, Oklahoma cents per gallon	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63
Bunker C for ships:													
New York dollars per barrel	1.86	1.86	1.86	1.86	1.86	1.86	1.86	1.77	1.77	1.77	1.77	1.77	1.82
Gulf Coast do	1.06	1.06	1.06	1.06	1.06	1.06	1.06	.97	.97	.97	.97	.97	1.02
California do	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Diesel oil for ships:													
New York do	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78
Gulf Coast do	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
California do	1.42	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
1945													
41°–43° gravity w. w. kerosine at refineries, Oklahoma cents per gallon	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.38	4.37	4.33	4.37
Kerosine, tank-wagon at Chicago cents per gallon	10.60	10.60	10.60	10.60	10.60	10.60	10.60	10.48	10.30	10.30	10.56	10.60	10.54
No. 2 straw fuel oil at refineries, Oklahoma cents per gallon	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63	3.63
Bunker C for ships:													
New York dollars per barrel	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.55	1.55	1.54	1.51	1.69
Gulf Coast do	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97	.97
California do	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
Diesel oil for ships:													
New York do	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.78	2.15	2.15	2.15	2.15	2.57
Gulf Coast do	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65	1.65
California do	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45

[1] Platt's Oil Price Handbook.

The War Shipping Administration ordered two important changes regarding tanker rates in 1945. The surcharge of 200 percent to cover wartime risks and expenses, dating from April 6, 1942, was discontinued by Rate Order 378, as of September 1, 1945. Tanker rates in the past have been on a barrel basis and differed for the several petroleum products. The Gulf to Atlantic coast (not east of New York) charge on No. 2 fuel oil was 42 cents a barrel, dating from January 19, 1942, through October 14, 1945, and the rate for crude and heavy fuel oil (10°–19.9° gravity) was 48 cents a barrel over the same period. Effective October 15, 1945, tanker rates were put on a long-ton (2,240 pounds) basis for all petroleum products. The freight charge from Gulf ports to New York harbor was placed at $2.85 a ton, and as the average gravities vary for the different products the new rate is about 38 cents a barrel for No. 2 distillate and 43.8 cents for heavy fuel oil.

There were no changes in representative wholesale or bulk fuel-oil prices in 1945, except for some downward adjustments in the Atlantic Coast area at the close of the War. The Office of Price Administration, in its Amendment 32 to Maximum Price Regulation 88, effective September 1, 1945, reduced the wholesale price of petroleum products in the Atlantic Coast marketing area "to restore normal prices based on the return of tankers to coastwise petroleum movements." As a result of this change, the price of bunker C at New York Harbor was reduced from $1.77 to $1.55 a barrel, and the quotation for Diesel fuel for ships' bunkers was lowered from $2.78 to $2.15 a barrel. The difference between the old and the new prices represented, broadly speaking, the added cost of tanker transportation under war conditions. Heavy fuel oil, including bunker C, was reduced further, because of lower tanker rates up to 5 cents a barrel at Atlantic Coast ports by OPA Amendment 37 to M. P. R. 88, effective November 28, 1945. The price of bunker C at New York Harbor under this order was dropped to $1.51 a barrel or 4 cents below the former quotation.

As with wholesale fuel-oil prices, there were some after-the-war price adjustments in representative retail prices, as shown in average monthly quotations for various cities compiled by Bureau of Labor Statistics, United States Department of Labor. The consumer prices of fuel oil and other petroleum products sold on the eastern seaboard were reduced in line with lower wholesale prices put into effect on September 1, 1945. The average retail price of No. 2 fuel oil in the New York area (9.09 cents a gallon dating from December 1942) was dropped to 7.58 cents a gallon on September 17, 1945, by OPA Amendment 13 R. M. P. R. 137. The 17-day lag between the wholesale and retail price changes was made to allow dealers to dispose of stocks bought at the higher level. Because of a shortage in supplies, the OPA allowed shippers of fuel oil from PAW district 3 to district 1 a temporary increase in the price of light fuel oils up to 2 cents a gallon—Amendment 38, M. P. R. 88, effective December 19, 1945, and ending April 30, 1946. As a result of this allowance the average retail quotation of No. 2 at New York advanced to 7.60 cents a gallon. The average retail price of No. 2 fuel oil in Chicago (7.45 cents a gallon, dating from September 1944) declined to 7.19 cents in September 1945. There was an advance to 7.40 cents in November and then again to 7.45 cents a gallon in December 1945. These changes were the result of prevailing market conditions, as the OPA issued no new price regulations for the Chicago area during the final months of 1945.

LUBRICATING OIL

The demand for lubricating oil totaled 41.1 million barrels in 1944 and rose to 41.9 million in 1945. Exports declined from 8.7 million barrels to 6.6 million, while domestic demand increased from 32.4 million barrels to 35.3 million.

The yield of lubricating oil from crude has declined from 2.8 percent in 1941 to 2.5 percent in 1944 and 2.4 percent in 1945. Refinery stocks of lubricating oil amounted to 7,773,000 barrels at the end of 1945, showing a minor decline during the year.

The refinery production of lubricating oil amounted to 41,867,000 barrels in 1945, compared with 41,106,000 barrels in 1944. Production in the Appalachian district was 4,891,000 barrels in 1945, compared with 5,278,000 barrels in 1944. The principal increases in production in 1945 were in the Oklahoma-Kansas and Texas Gulf Coast districts.

Under present abnormal conditions, it has not been possible to estimate the relative consumption of lubricants for automotive and nonautomotive purposes.

Comparative analyses of statistics for lubricating oil in the United States, 1944–45, by months and districts

Month and district	Production (thousands of barrels)		Yield (percent)		Domestic demand (thousands of barrels)		Stocks (thousands of barrels)	
	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]
By months:								
January	3,379	3,504	2.5	2.4	2,576	3,094	8,006	7,796
February	3,158	3,062	2.5	2.3	2,570	2,787	7,942	7,641
March	3,488	3,589	2.5	2.5	2,692	3,247	8,011	7,423
April	3,273	3,716	2.5	2.6	2,570	3,265	8,068	7,307
May	3,337	3,882	2.4	2.6	2,631	3,370	7,771	7,026
June	3,453	3,567	2.5	2.4	2,754	3,132	7,590	6,770
July	3,364	3,645	2.3	2.3	2,625	3,261	7,426	6,321
August	3,356	3,712	2.4	2.4	2,734	3,120	7,169	6,505
September	3,458	3,128	2.4	2.4	2,556	2,327	7,364	6,840
October	3,672	3,265	2.5	2.5	2,941	2,577	7,452	7,221
November	3,587	3,485	2.6	2.5	3,032	2,532	7,562	7,595
December	3,581	3,312	2.5	2.3	2,682	2,606	7,815	7,773
Total United States	41,106	41,867	2.5	2.4	32,363	35,318	7,815	7,773
By districts:								
East Coast	8,237	8,358	3.2	3.1	(2)	(2)	2,428	2,327
Appalachian	5,278	4,891	9.4	8.7			605	506
Indiana, Illinois, Kentucky, etc.	4,526	4,446	1.6	1.6			830	794
Oklahoma, Kansas, and Missouri	4,627	5,361	3.5	3.9			494	629
Texas Inland	208	248	.3	.3			23	34
Texas Gulf Coast	10,614	10,989	2.6	2.7			1,736	1,791
Louisiana Gulf Coast	2,157	2,036	2.6	2.1			153	204
Arkansas and Louisiana Inland	1,438	1,453	5.1	5.2			125	157
Rocky Mountain	256	265	.6	.6			88	77
California	3,765	3,820	1.3	1.2			1,333	1,254
Total United States	41,106	41,867	2.5	2.4	32,363	35,318	7,815	7,773

[1] Subject to revision.
[2] Figures not available.

Average monthly refinery prices of five selected grades of lubricating oil in the United States, 1944–45, in cents per gallon [1]

Grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1944													
Oklahoma:													
200 viscosity, No. 3 color, neutral	15.00	15.00	15.00	15.00	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	14.00
150–160 viscosity at 210°, bright stock, 10–25 pour test	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	30.25	30.25	30.25	30.38	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.43
600 steam-refined, cylinder stock, filterable	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
1945													
Oklahoma:													
200 viscosity, No. 3 color, neutral	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
150–160 viscosity at 210°, bright stock, 10–25 pour test	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75	22.75
Pennsylvania:													
200 viscosity, No. 3 color, neutral, 420–425 flash, 25 pour test	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50
600 steam-refined, cylinder stock, filterable	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Gulf Coast: 500 viscosity, No. 2½–3½ color, neutral	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00

[1] National Petroleum News.

OTHER PRODUCTS

Wax.—The total demand for wax has increased from 737 million pounds in 1941 to 796 million in 1944 and 831 million in 1945. Exports have been substantially below the prewar level. Domestic demand totaled 524 million pounds in 1941 and rose to 633 million in 1944 and 673 million in 1945.

The refinery production of wax was 818 million pounds in 1945. About 38 percent of the total was produced in the East Coast district, 15 percent in the Texas Gulf Coast district, and 12 percent in the Appalachian district.

Comparative analyses of statistics for wax in the United States, 1944–45, by months and districts

[Thousands of pounds]

Month and district	Production 1944	Production 1945 [1]	Domestic demand 1944	Domestic demand 1945 [1]	Exports 1944	Exports 1945 [1]	Stocks 1944	Stocks 1945 [1]
By months:								
January	71,120	71,960	62,459	57,752	10,061	19,528	80,640	88,480
February	65,800	64,960	54,923	51,956	11,437	15,244	80,080	86,240
March	79,800	81,480	58,487	65,288	16,833	15,072	84,560	87,360
April	76,440	70,560	54,753	63,000	12,167	10,380	94,080	84,840
May	65,520	71,120	49,847	65,736	15,953	9,024	93,800	81,200
June	60,480	70,280	51,638	71,325	11,082	8,755	91,560	71,400
July	63,560	71,400	45,903	56,897	15,417	7,586	93,800	78,680
August	64,120	73,360	47,866	59,955	14,014	9,987	96,040	82,600
September	62,160	54,040	51,926	38,637	11,354	14,036	94,920	84,280
October	67,480	58,240	50,442	45,590	15,078	12,970	96,880	84,280
November	63,560	66,640	49,674	51,184	15,846	16,576	94,920	83,160
December	67,200	63,840	55,326	45,816	12,994	19,144	93,800	82,040
Total United States	807,240	817,880	633,244	673,136	162,236	158,302	93,800	82,040
By districts:								
East Coast	286,720	309,400	(2)	(2)	(2)	(2)	27,160	28,840
Appalachian	102,480	102,480					17,360	18,480
Indiana, Illinois, Kentucky, etc.	62,160	60,200					15,960	9,800
Oklahoma, Kansas, and Missouri	84,840	90,160					5,320	5,880
Texas Inland	2,520	2,240					280	--------
Texas Gulf Coast	129,080	122,080					10,640	9,240
Louisiana Gulf Coast	99,680	82,320					1,680	1,400
Rocky Mountain	24,640	25,200					14,000	7,000
California	15,120	23,800					1,400	1,400
Total United States	807,240	817,880	633,244	673,136	162,236	158,302	93,800	82,040

[1] Subject to revision.
[2] Figures not available.

Average monthly refinery price of 122°–124° white crude scale wax at Pennsylvania refineries, 1941–45, in cents per pound [1]

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1941	2.73	2.63	2.86	3.28	3.85	4.96	5.13	5.26	5.96	6.25	6.21	4.25	4.45
1942	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1943	4.25	4.25	4.25	4.25	4.55	4.25	4.52	4.25	4.25	4.25	4.25	4.25	4.25
1944	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1945	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25

[1] National Petroleum News.

Coke.—The production of petroleum coke amounted to 2,023,000 short tons in 1945 compared with 1,803,000 tons in 1944. Exports declined from 187,000 tons to 158,000 tons and domestic demand rose from 1,665,000 tons in 1944 to 1,841,000 tons in 1945. With the termination of wartime requirements, petroleum coke has become available for domestic heating purposes.

The principal refinery districts producing petroleum coke in 1945 were Indiana-Illinois and Texas Gulf Coast. The Indiana-Illinois district produced 56 percent of the total in 1945, compared with over 61 percent in 1944.

Comparative analyses of statistics for petroleum coke in the United States, 1944–45, by months and districts

Month and district	Production (thousands of short tons)		Yield (percent)		Domestic demand (thousands of short tons)		Stocks (thousands of short tons)	
	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]	1944	1945 [1]
By months:								
January	116.2	181.4	0.4	0.6	174.0	186.8	179.4	174.4
February	137.6	163.0	.5	.6	130.2	194.6	165.6	131.2
March	143.6	172.4	.5	.6	117.6	161.6	172.8	124.8
April	137.0	184.2	.5	.6	123.4	149.4	166.4	140.8
May	144.8	178.6	.5	.6	148.8	147.6	141.4	150.4
June	135.4	171.6	.5	.6	136.4	157.0	127.2	147.6
July	157.8	184.8	.6	.6	132.4	165.6	129.6	154.0
August	158.2	180.4	.6	.6	144.4	153.8	115.8	160.4
September	155.4	148.2	.6	.6	134.8	131.8	116.0	162.2
October	181.2	143.6	.6	.5	145.8	124.8	137.2	159.0
November	163.8	152.0	.6	.5	133.6	124.2	161.6	159.4
December	172.4	162.8	.6	.6	144.0	144.2	187.2	158.2
Total United States	1,803.4	2,023.0	.5	.6	1,665.4	1,841.4	187.2	158.2
By districts:								
East Coast	2.2	73.6	(2)	.1	(3)	(3)	1.0	1.0
Appalachian	24.8	30.2	.2	.3			2.4	3.0
Indiana, Illinois, Kentucky, etc.	1,110.4	1,138.8	2.0	2.1			104.6	45.4
Oklahoma, Kansas, and Missouri	137.8	148.6	.5	.5			7.8	4.4
Texas Inland	117.6	126.2	.7	.7			10.4	3.8
Texas Gulf Coast	153.2	200.8	.2	.2			8.2	11.8
Louisiana Gulf Coast	138.6	141.0	.8	.7			.8	.8
Rocky Mountain	46.8	38.8	.6	.4			21.6	11.6
California	72.0	125.0	.1	.2			30.4	76.4
Total United States	1,803.4	2,023.0	.5	.6	1,665.5	1,841.4	187.2	158.2

[1] Subject to revision.
[2] Less than 0.1 percent.
[3] Figures not available.

Asphalt and road oil.—The domestic demand for asphalt declined from 6,932,500 short tons in 1944 to 6,698,200 tons in 1945, while exports increased from 127,100 tons to 224,800 tons. The consumption of road oil. however, showed a material gain—from 1,560,000 barrels in 1944 to 2,505,000 barrels in 1945. Owing to wartime restrictions, consumption was curtailed, so that a large gain in demand may be expected in 1946. The demand for road oil in 1941 totaled 8,980,000 barrels.

Detailed statistics for asphalt and road oil appear in the chapter of this volume on Asphalt and Related Bitumens.

Still gas.—The output of still gas increased from 368,061 million cubic feet in 1944 to 372,449 million cubic feet in 1945. The largest production of still gas, by refinery districts, in 1945 was 108 billion cubic feet in the Texas Gulf Coast, 63 billion in the Indiana-Illinois district, 50 billion in the East Coast, and 48 billion in California. The major part of this still gas is used for fuel at refineries.

Production of still gas in the United States, 1943–45, by districts

District	1943		1944		1945 [1]	
	Millions of cubic feet	Equivalent, in thousands of barrels	Millions of cubic feet	Equivalent, in thousands of barrels	Millions of cubic feet	Equivalent, in thousands of barrels
East Coast	44, 449	12, 347	50, 501	14, 028	49, 547	13, 763
Appalachian	10, 249	2, 847	12, 319	3, 422	12, 632	3, 509
Indiana, Illinois, Kentucky, etc	57, 855	16, 071	66, 294	18, 415	62, 759	17, 433
Oklahoma, Kansas, and Missouri	24, 059	6, 683	25, 337	7, 038	26, 489	7, 358
Texas Inland	14, 080	3, 911	15, 239	4, 233	16, 128	4, 480
Texas Gulf Coast	96, 235	26, 732	114, 966	31, 935	108, 227	30, 063
Louisiana Gulf Coast	17, 824	4, 951	29, 462	8, 184	34, 225	9, 507
Arkansas and Louisiana Inland	4, 280	1, 189	4, 648	1, 291	6, 059	1, 683
Rocky Mountain	5, 422	1, 506	6, 858	1, 905	8, 114	2, 254
California	37, 865	10, 518	42, 437	11, 788	48, 269	13, 408
Total, United States	312, 318	86, 755	368, 061	102, 239	372, 449	103, 458

[1] Subject to revision.

Miscellaneous oils.—The domestic demand for this group of products has risen steadily—from 11,862,000 barrels in 1941 to 36,291,000 barrels in 1945. The major products in this group are liquefied gases for fuel uses and for chemical and rubber manufacture. The supply of miscellaneous oils is derived from natural gasoline and cycle plants and from refinery production. Transfers of liquefied gases from natural gasoline and cycle plants have increased from 6,281,000 barrels in 1941 to 18,383,000 barrels in 1945. Refinery production of miscellaneous oils has risen from 6,266,000 barrels in 1941 to 19,080,000 barrels in 1945. These figures indicate that the supply from the two sources is approximately the same. No detailed break-down of the refinery output of miscellaneous oils in 1944 and 1945 is available.

WORLD PRODUCTION [2]

The world production of crude petroleum continued its steadily rising trend (interrupted only in 1930–32, 1938, and 1942). A 2-percent gain in the output of the United States from 1944 to 1945 was more than sufficient to offset a decrease of 2 percent in the rest of the world.

The Western Hemisphere contributed 83 percent of the total world petroleum production in 1945. The United States alone supplied 65 percent of the world output and Venezuela 12 percent. In the Eastern Hemisphere, the U. S. S. R. furnished 6 percent of the world total, so far as incomplete statistics would indicate.

In the United States, military demands during the first 7 months of 1945 and the removal of restrictions on civilian consumption during the last 5 months were reflected in an increase in demand of 6 percent and an increase in production of 2 percent. In Mexico increasing industrialization and growing home consumption promoted a 14-percent increase in the production of crude petroleum.

[2] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

In Venezuela a decline in the output of the old Cabimas field from 1944 to 1945 was more than made up by increased production at Tia Juana and Lagunillas, as well as in minor fields of the Maracaibo Basin. In eastern Venezuela the Jusepin, Mulata, Quiriquire, and Guara fields led the general advance. Colombia produced 3 percent more petroleum in 1945 than in 1944. In Peru, declines in the older La Brea-Parinas and Lobitos fields were reflected in a general 5-percent decrease in output. In Argentina, both Government and private production were less, resulting in an output 6 percent lower in 1945 than in 1944.

Petroleum production in Europe suffered considerably from the effects of war, so far as incomplete and unofficial statistics permit a judgment. Only Rumania appears to have increased its production in 1945 over 1944.

In the Middle East, the removal of the submarine threat from the seas permitted petroleum production to expand, even beyond its prewar levels, in Iran, Bahrein Island, Saudi Arabia, and probably Iraq.

Crude petroleum produced in principal countries of the world, 1940–45, in thousands of barrels

[Compiled by B. B. Waldbauer]

Country	1940	1941	1942	1943	1944	1945
North America:						
Canada	8,591	10,134	10,365	10,052	10,099	8,550
Mexico	44,036	42,196	34,815	35,163	38,203	43,547
Trinidad	22,227	20,506	22,069	21,385	22,139	21,093
United States	1,353,214	1,402,228	1,386,645	1,505,613	1,677,904	1,711,103
Other North America [1]	142	150	150	150	150	150
Total North America	1,428,210	1,475,214	1,454,044	1,572,363	1,748,495	1,784,443
South America:						
Argentina	20,609	21,873	23,704	27,714	24,230	22,880
Bolivia	288	235	308	334	314	[1] 300
Brazil	2	3	31	80	80	79
Colombia	25,593	24,553	10,487	13,261	22,291	22,825
Ecuador	2,349	1,557	2,278	2,378	2,892	2,664
Peru	12,126	11,935	13,629	14,654	14,386	13,748
Venezuela	185,570	228,430	147,675	177,631	257,046	323,415
Total South America	246,537	288,586	198,112	236,052	321,239	385,911
Europe:						
Albania	1,497	1,381	1,450	715	[1] 765	(2)
Czechoslovakia	163	183	271	200	[1] 185	(2)
France	496	414	463	[1] 500	[1] 500	29
Germany	7,371	6,313	5,208	[1] 6,500	[1] 7,600	(2)
Austria	2,808	4,263	5,920	[1] 7,800	[1] 9,760	(2)
Hungary	1,881	3,178	5,013	6,313	6,104	4,898
Italy	85	95	101	[1] 75	[1] 75	(2)
Poland	3,891	3,319	3,400	3,500	3,000	[3] 705
Rumania	43,168	40,517	42,094	39,182	26,191	34,475
U. S. S. R. [1] [4]	218,600	238,150	227,470	200,750	275,000	148,953
United Kingdom	124	223	605	839	703	532
Other Europe [1]	10	10	10	10	10	[1] 10
Total Europe [4]	280,094	298,046	292,005	266,384	329,893	[1] 204,802
Asia:						
Bahrein Island	7,074	6,794	6,241	6,572	6,714	7,309
Burma	7,731	7,762	2,500	1,000	[1] 750	(2)
China	10	86	340	447	507	(2)
India, British	2,302	2,899	2,792	2,279	[1] 2,500	(2)
Iran (Persia)	66,317	50,777	72,256	74,612	102,045	129,452
Iraq	24,225	12,650	19,726	24,848	30,943	(2)
Japan (including Formosa (Taiwan))	2,639	2,659	[1] 3,000	[1] 3,500	[1] 3,000	(2)

See footnotes at end of table.

Crude petroleum produced in principal countries of the world, 1940–45, in thousands of barrels—Continued

Country	1940	1941	1942	1943	1944	1945
Asia—Continued						
Netherlands Indies	62,011	53,704	[1] 9,000	[1] 20,000	[1] 40,000	(2)
Sakhalin [1]	4,000	4,000	4,000	5,000	5,000	6,000
Sarawak and Brunei	7,047	6,864	[1] 3,000	[1] 4,500	[1] 6,000	(2)
Saudi Arabia	5,075	4,310	4,530	4,868	7,794	21,311
Total Asia [5]	188,431	152,505	127,385	147,626	205,253	[1] 240,322
Africa:						
Egypt	6,505	8,546	8,275	8,953	9,416	9,406
Other Africa [1]	27	27	27	25	30	25
Total Africa	6,532	8,573	8,302	8,978	9,446	9,431
Australia and New Zealand	3	3	3	5	5	5
Undistributed [1]	14	14	15	15	14	15
Grand total	2,149,821	2,222,941	2,079,866	2,231,423	[1] 2,614,345	[1] 2,624,929

[1] Estimate.
[2] Data not available; estimate included in total.
[3] Present borders.
[4] Includes U. S. S. R. fields in Asia, other than Sakhalin.
[5] Exclusive of U. S. S. R. fields in Asia, other than Sakhalin, which is included with U. S. S. R. in Europe.

FOREIGN TRADE [3]

IMPORTS

Imports of mineral oils, crude and refined, into continental United States increased 23 percent from 1944 to 1945. They constituted 6 percent of the total new supply in continental United States in 1945 compared with 5 percent in 1944.

Crude petroleum, residual fuel oil, and distillate fuel oil together made up 96 percent of the total mineral-oil imports in 1944 and 97 percent in 1945. Virtually all these imports came from ports of the Caribbean Sea and the Gulf of Mexico. Venezuela supplied 82 percent of the crude petroleum imported in 1944 and 85 percent in 1945, Colombia 17 percent in 1944 and 11 percent in 1945, and Mexico 1 percent in 1944 and 3 percent in 1945. Of the residual fuel oil imported, the Netherlands West Indies furnished 98 percent in 1944 and 97 percent in 1945. Minor amounts were imported in both years from Trinidad, Mexico, Canada, Colombia, and Venezuela.

Of the distillate fuel oil imported into the United States, the Netherlands West Indies was the principal source, supplying 69 percent in 1944 and 87 percent in 1945. The share of Mexico in this trade decreased from 14 percent in 1944 to 5 percent in 1945; that of Venezuela from 12 percent in 1944 to 2 percent in 1945; and that of Trinidad from 6 percent in 1944 to 4 percent in 1945.

Of all mineral oils, crude and refined, imported into the United States, the Netherlands West Indies supplied 51 percent in 1944 and 41 percent in 1945, Venezuela 38 percent in 1944 and 48 percent in 1945, Colombia 7 percent in 1944 and 6 percent in 1945, Mexico 2 percent in 1944 and 3 percent in 1945, and Trinidad 1 percent in both 1944 and 1945.

[3] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

Mineral oils, crude and refined, imported into continental United States, 1944–45, by months [1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1944													
Crude petroleum	3,083	3,183	2,281	3,371	4,217	3,719	3,195	4,975	3,802	5,575	3,377	4,027	44,805
Refined products:													
Gasoline, finished	12	10	262	475	925	262	138	227	373	55	320	89	3,148
Kerosine	71	-	-	-	76	-	-	-	-	-	-	-	147
Distillate fuel oil	1,322	600	798	599	853	447	468	392	199	228	409	781	7,096
Residual fuel oil	2,523	2,822	3,174	3,856	4,035	3,477	3,685	2,950	3,269	2,276	2,239	2,247	36,553
Asphalt	50	38	88	4	7	9	99	-	40	37	-	126	498
Unfinished oils, other	-	7	2	-	-	-	-	-	-	-	-	-	9
	7,061	6,660	6,605	8,305	10,113	7,914	7,585	8,544	7,683	8,171	6,345	7,270	92,256
1945 [2]													
Crude petroleum	3,969	3,939	6,197	5,151	6,621	5,620	7,601	7,230	5,517	7,347	7,395	7,508	74,095
Refined products:													
Gasoline, finished	141	201	110	87	299	352	142	202	69	105	99	-	1,807
Distillate fuel oil	6	218	649	758	647	417	192	264	217	239	596	551	4,754
Residual fuel oil	2,773	2,247	3,862	3,249	2,808	3,184	2,011	1,894	1,257	2,490	3,395	2,387	31,557
Paraffin wax	-	-	-	1	-	-	1	2	1	1	-	-	6
Asphalt	46	3	-	125	89	102	46	47	130	39	269	-	896
Unfinished oils, other	-	-	-	-	-	-	-	-	-	67	-	191	258
	6,935	6,608	10,818	9,371	10,464	9,675	9,993	9,639	7,191	10,288	11,754	10,637	113,373

[1] Imports of crude as reported to Bureau of Mines; imports of refined products compiled from records of U. S. Department of Commerce; figures may differ slightly from those used throughout other sections of this report.
[2] Subject to revision.

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EXPORTS

Continental United States continued to be a net exporter of mineral oils. The excess of all petroleum exports over all petroleum imports decreased from 115 million barrels (revised figure) in 1944 to 71 million barrels in 1945. In crude petroleum, however, imports were larger than exports in both years. The excess of crude imports decreased from 10.6 million barrels in 1944 to 6 million barrels in 1945. On the other hand, exports of refined oils exceeded imports of refined oils, with the exception of residual fuel oil. This excess decreased from 126 million barrels (revised figure) in 1944 to 112 million barrels in 1945. Imports of residual fuel oil exceeded exports by 24 million barrels (revised figure) in 1944 and by 20 million barrels in 1945.

Exports and Territorial shipments of crude petroleum from continental United States decreased 4 percent from 1944 to 1945. Canada received 97 percent of these outgoing shipments in 1944 and 93 percent in 1945; the United Kingdom 1 percent in 1944 and 4 percent in 1945; and Cuba 2 percent in both years.

In absolute amounts, exports and Territorial shipments of refined mineral oils were 13 percent less in 1945 than in 1944. The decreases were general among the major refined oils.

Of the exports of major refined oils, 78 percent in 1944 and 77 percent in 1945 went to Europe. The United Kingdom received 75 percent of the total in 1944 and 69 percent in 1945, and the U. S. S. R. 3 percent in 1944 and 4 percent in 1945.

Other North American countries received 6 percent of the total exports both in 1944 and in 1945. Canada's share of the whole decreased from 4 percent (revised figure) in 1944 to 3 percent in 1945.

Exports of major refined mineral oils from the United States to Oceania amounted to 5 percent of the total outward shipments from the United States in 1944 and to 1½ percent in 1945. Australia received 3 percent of the whole in 1944 and 1½ percent in 1945.

Mineral oils, crude and refined, shipped from continental United States, including shipments to noncontiguous territories, 1944–45, by classes and months [1]

[Thousands of barrels]

Class	January	February	March	April	May	June	July	August	September	October	November	December	Total
1944													
Crude petroleum	2,488	1,904	2,105	2,891	3,136	3,642	3,516	3,387	3,354	2,990	3,001	1,824	34,238
Refined products:													
Motor fuel [2]	5,154	5,650	5,364	7,315	9,438	11,640	9,580	11,025	9,094	11,087	7,407	7,783	100,537
Kerosine	257	156	172	422	361	399	729	944	336	402	438	272	4,888
Distillate fuel oil	1,640	2,494	2,303	4,184	4,077	5,534	5,457	5,770	3,869	3,697	2,371	2,095	43,491
Residual fuel oil	710	833	1,311	726	1,677	1,860	1,228	611	696	713	1,399	772	12,536
Lubricating oil	578	652	727	646	1,003	880	903	879	707	643	445	646	8,709
Paraffin wax	36	41	60	43	57	40	55	50	41	54	57	46	580
Coke	105	106	94	100	105	66	115	138	102	71	29	14	1,045
Asphalt	55	117	53	32	23	102	75	50	49	56	39	48	699
Miscellaneous oils	61	85	86	78	90	71	52	68	61	81	78	82	893
Total refined	8,596	10,134	10,170	13,546	16,831	20,592	18,194	19,535	14,955	16,804	12,263	11,758	173,378
Total crude and refined	11,084	12,038	12,275	16,437	19,967	24,234	21,710	22,922	18,309	19,794	15,264	13,582	207,616
1945 [3]													
Crude petroleum	1,302	1,599	1,973	2,663	3,208	2,915	3,533	3,308	3,166	3,603	3,399	2,329	32,998
Refined products:													
Motor fuel [2]	10,714	7,637	12,409	12,572	11,649	9,935	6,443	2,973	4,440	2,442	2,973	4,663	88,850
Kerosine	191	283	501	412	664	571	560	563	823	639	518	433	6,158
Distillate fuel oil	2,467	1,755	2,530	3,381	4,217	4,917	3,375	2,292	1,631	2,505	2,624	2,133	33,827
Residual fuel oil	1,016	594	1,475	1,026	1,331	1,175	1,627	945	560	790	579	801	11,919
Lubricating oil	429	430	560	567	793	691	833	408	466	307	579	528	6,591
Paraffin wax	70	54	54	37	32	31	27	36	50	46	59	69	565
Coke	37	58	86	94	107	87	64	101	73	110	137	99	1,053
Asphalt	117	57	77	91	104	76	71	101	140	135	143	124	1,236
Miscellaneous oils	83	85	91	68	86	84	80	87	71	96	124	121	1,076
Total refined	15,124	10,953	17,783	18,248	18,983	17,567	13,080	7,506	8,254	7,070	7,736	8,971	151,275
Total crude and refined	16,426	12,552	19,756	20,911	22,191	20,482	16,613	10,814	11,420	10,673	11,135	11,300	184,273

[1] Exports of crude as reported to Bureau of Mines; export and shipments of refined products compiled from records of U. S. Department of Commerce; figures may differ slightly from those used throughout other sections of this report.
[2] Includes benzol, natural gasoline, and antiknock compounds.
[3] Subject to revision.

Major petroleum products exported from continental United States, by countries of destination, and shipments to and exports from noncontiguous Territories, 1943–45 [1]

[Thousands of barrels, except wax, which is in thousands of pounds]

Country	Motor fuel [2]			Kerosine			Fuel oil			Lubricating oil			Wax		
	1943	1944	1945	1943	1944	1945	1943	1944	1945	1943	1944	1945	1943	1944	1945
Exports to foreign countries:															
North America:															
Bermuda	(3)	(3)	16	(3)	(3)	(3)	-----	(3)	-----	2	2	2	(4)	1	(4)
Canada	2, 964	2, 522	2, 329	269	186	241	1, 330	2, 210	1, 560	378	383	292	22, 441	19, 431	24, 273
Cuba	303	271	436	(3)	2	1	730	2, 343	1, 064	52	57	68	2, 117	4, 250	2, 644
Curaçao (N. W. I.)	(3)	(3)	(3)	-----	-----	-----	-----	1	(3)	53	13	10	1	1	1
Iceland	(3)	2	119	-----	-----	-----	-----	-----	9	10	10	12	114	85	53
Mexico	603	636	812	61	86	118	723	833	825	200	192	271	5, 581	1, 804	8, 131
Panama: Canal Zone	44	72	2	-----	(3)	(3)	47	-----	219	9	10	20	-----	-----	-----
Trinidad and Tobago	(3)	(3)	(3)	(3)	(3)	-----	-----	-----	(3)	26	13	16	171	24	120
Other North America	200	66	104	33	22	24	91	47	64	82	68	86	3, 241	6, 822	4, 023
	4, 114	3, 569	3, 818	363	296	384	2, 921	5, 434	3, 741	812	748	777	33, 666	32, 418	39, 245
South America:															
Argentina	(3)	(3)	1	-----	(3)	1	38	52	170	13	12	23	51	-----	334
Bolivia	14	3	7	3	1	(3)	(3)	1	(3)	20	17	8	1, 353	3, 287	2, 205
Brazil	53	30	254	22	4	8	70	-----	18	241	492	417	1, 285	3, 856	4, 014
Chile	5	18	22	(3)	1	1	28	9	1	70	76	76	5, 985	10, 422	14, 423
Colombia	3	(3)	(3)	-----	-----	(3)	-----	-----	-----	22	29	35	5, 515	12, 732	12, 681
Peru	10	4	32	(3)	(3)	(3)	(3)	-----	-----	30	34	25	1, 932	7, 408	6, 241
Surinam	(3)	(3)	(3)	(3)	4	-----	(3)	-----	-----	3	2	2	30	9	5
Uruguay	2	2	7	(3)	(3)	(3)	2	-----	-----	25	20	27	199	502	679
Venezuela	3	1	2	-----	-----	-----	-----	-----	(3)	44	61	105	1, 881	5, 641	1, 688
Other South America	2	(3)	3	-----	3	-----	1	-----	2	21	16	19	1, 382	2, 460	2, 366
	92	58	328	25	13	10	139	62	191	489	759	737	19, 613	46, 317	44, 636
Europe:															
Belgium and Luxembourg	-----	-----	147	-----	-----	(3)	-----	-----	183	-----	-----	32	-----	-----	-----
Eire	-----	66	(3)	-----	-----	-----	-----	30	-----	-----	5	1	2, 325	1, 518	526
France	-----	-----	1, 898	-----	-----	150	-----	-----	699	-----	-----	102	-----	-----	539
Norway	-----	-----	(3)	-----	-----	-----	-----	-----	100	-----	-----	(3)	-----	-----	654
Portugal	4	1	(3)	(3)	(3)	(3)	1	(3)	-----	40	40	67	683	721	1, 704
Spain	-----	-----	(3)	-----	-----	-----	(3)	-----	-----	95	73	103	1, 729	559	1, 872
Sweden	-----	(3)	555	-----	-----	56	(3)	67	671	52	65	145	22	580	1, 282
Switzerland	-----	-----	1	-----	-----	-----	-----	-----	223	-----	-----	21	-----	-----	331
U. S. S. R.	2, 709	4, 576	4, 581	17	39	51	264	312	1, 210	62	250	268	5, 979	1, 273	26

United Kingdom	31,063	75,886	62,092	3,782	4,278	4,984	27,444	43,700	31,272	2,969	3,833	1,862	76,544	64,544	60,060
Other Europe	94	(3)	272	-------	-------	108	-------	-------	147	5	13	3	-------	(4)	38
	33,870	80,529	69,546	3,799	4,317	5,349	27,709	44,109	34,505	3,223	4,279	2,604	87,282	69,195	67,032
Asia:															
Ceylon	-------	3,769	7,211	(3)	-------	(3)	-------	-------	(3)	43	37	49	-------	-------	-------
China and Hong Kong	(3)	1	121	-------	-------	38	-------	-------	23	17	1	28	-------	-------	-------
India and Dependencies	4	2,271	1,158	(3)	(3)	-------	(3)	-------	(3)	1,133	571	917	138	261	57
Iran	(3)	(3)	(3)	-------	-------	-------	-------	-------	-------	62	17	28	-------	-------	1
Iraq	-------	-------	-------	-------	-------	-------	1	-------	-------	77	35	39	6	-------	-------
Turkey	(3)	(3)	(3)	-------	-------	(3)	-------	-------	-------	-------	38	51	-------	344	587
Other Asia	-------	(3)	2	(3)	(3)	1	(3)	-------	16	108	46	67	301	28	834
	4	6,041	8,492	(3)	(3)	39	1	-------	39	1,440	745	1,179	445	633	1,479
Africa:															
Algeria	(3)	(3)	247	-------	-------	-------	(3)	-------	196	5	(3)	(3)	-------	-------	18
Belgian Congo	50	(3)	1	4	-------	-------	13	-------	-------	35	30	24	46	209	4
Egypt	1,537	2,265	1,308	(3)	(3)	(3)	-------	-------	-------	634	304	191	162	155	351
Gold Coast	128	95	(3)	22	9	-------	56	11	-------	27	18	14	-------	-------	6
Liberia	3	(3)	(3)	1	-------	1	(3)	-------	-------	1	-------	1	66	97	103
Morocco	-------	-------	124	-------	-------	27	-------	-------	174	(3)	(3)	(3)	(4)	7	(4)
Nigeria	(3)	70	(3)	(3)	1	(3)	(3)	-------	-------	12	17	11	-------	-------	1
Southern Rhodesia	-------	-------	-------	-------	-------	(3)	-------	-------	-------	25	34	16	731	(4)	45
Union oj South Africa	(3)	1	4	(3)	(3)	18	116	-------	-------	356	367	261	19,239	8,597	5
Other Africa	-------	46	6	(3)	14	3	(3)	28	3	207	184	127	189	288	318
	1,718	2,477	1,690	27	24	49	185	39	373	1,302	954	645	20,433	9,353	851
Oceania:															
Australia	7,433	3,549	1,788	166	-------	53	3,389	748	6	1,082	977	389	5,780	4,283	3,266
British Oceania	19	-------	14	8	12	15	2	(3)	34	2	3	5	-------	-------	-------
New Guinea (Australian)	-------	2,066	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

See footnotes at end of table.

Major petroleum products exported from continental United States, by countries of destination, and shipments to and exports from noncontiguous Territories, 1943–45 [1]—Continued

[Thousands of barrels, except wax, which is in thousands of pounds]

Country	Motor fuel [2]			Kerosene			Fuel oil			Lubricating oil			Wax		
	1943	1944	1945	1943	1944	1945	1943	1944	1945	1943	1944	1945	1943	1944	1945
Exports to foreign countries—Continued															
Oceania—Continued															
New Zealand	1,125	156	336	45	2	15	1,735	445	17	188	95	94	5,580	45	1,793
Other Oceania	15	18	24	5	6	9	8	4	6	4	2	2			(4)
	8,592	5,789	2,162	224	20	92	5,134	1,197	63	1,276	1,077	490	11,360	4,328	5,059
	48,390	98,463	86,036	4,438	4,670	5,923	36,089	50,841	38,912	8,542	8,562	6,432	172,799	162,244	158,302
Shipments from continental United States to noncontiguous Territories:															
Alaska	940	361	327				1,391	1,105	1,004	23	33	30			
Hawaii	2,645	1,691	1,547	223	213	204	2,531	4,091	5,235	92	107	80	70	84	117
Puerto Rico	3	1	143	(3)	(3)	45	2		17	33	81	66	92	77	109
Virgin Islands	22	41	20	6	7	6	18	8	5	1	1	1	(4)		
Other		(3)	1		(3)	1					(3)	(3)			
	3,610	2,094	2,038	229	220	256	3,942	5,204	6,261	149	222	177	162	161	226
Exports from noncontiguous Territories to foreign countries:															
Alaska	10	5	13		(3)	(3)	7	6	6		(3)	(3)			
Hawaii			(3)		(3)	(3)		(3)	(3)		(3)				
Puerto Rico	26	8	2	6	2		8	9	4		(3)	(3)			
	36	13	15	6	2	(3)	15	15	10		(3)	(3)			
Total net shipments from continental United States	51,964	100,544	88,059	4,661	4,888	6,179	40,016	56,030	45,163	8,691	8,784	6,609	172,961	162,405	158,528

[1] Compiled from the records of the U. S. Department of Commerce.
[2] Includes natural gasoline, naphtha, benzol, and antiknock compounds.
[3] Less than 1,000 barrels.
[4] Less than 1,000 pounds.

INTERCOASTAL SHIPMENTS [4]

Receipts of mineral oils, crude and refined, on the East coast from Gulf Coast ports were 2.7 times as large in 1945 as in 1944 but still were less than half as large as in 1940 and 1941. Crude petroleum was the largest single item in these 1945 shipments; it constituted 36 percent of the total shipments in 1945, compared with 19 percent in 1944. Shipments of gasoline and of distillate fuel oil were more than twice as large in 1945 than in 1944; shipments of kerosine more than 2½ times as large; and shipments of residual fuel oil nearly twice as large.

Mineral oils, crude and refined, shipped commercially from Gulf coast to east coast ports of the United States, 1944–45, by classes [1]

[Thousands of barrels]

Class	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1944													
Crude petroleum	253	782	1,716	344	209	------	225	939	1,857	2,809	2,315	2,799	14,248
Gasoline	1,902	2,021	2,113	2,121	1,882	2,157	2,047	2,053	1,429	1,770	1,811	1,827	23,133
Kerosine	922	609	295	90	259	96	393	224	542	441	799	515	5,185
Distillate fuel oil	1,093	749	646	257	383	501	529	1,305	970	2,063	2,400	2,227	13,123
Residual fuel oil	1,320	1,627	1,574	1,370	1,371	1,250	1,656	2,076	1,919	1,867	2,448	1,975	20,453
Miscellaneous oils	8	3	6	11	50	11	25	48	16	16	------	------	194
	5,498	5,791	6,350	4,193	4,154	4,015	4,875	6,645	6,733	8,966	9,773	9,343	76,336
1945													
Crude petroleum	3,498	3,016	3,392	2,968	3,023	2,685	4,240	3,944	6,469	9,854	15,888	14,525	73,502
Gasoline	2,316	1,931	2,327	1,941	2,277	2,023	1,746	3,340	5,346	7,054	9,813	8,679	48,793
Kerosine	780	646	605	505	320	936	716	734	1,174	1,383	2,101	3,328	13,228
Distillate fuel oil	2,695	3,926	1,918	711	404	588	1,197	1,281	2,055	2,563	4,437	6,400	28,175
Residual fuel oil	3,055	3,323	3,717	2,058	1,405	2,155	2,657	2,646	2,197	3,392	4,929	5,658	37,192
Lubricating oils	------	------	------	------	------	------	65	171	8	214	256	310	1,024
Miscellaneous oils	------	8	499	196	309	133	47	6	52	238	340	349	2,177
	12,344	12,850	12,458	8,379	7,738	8,520	10,668	12,122	17,301	24,698	37,764	39,249	204,091

[1] Petroleum Conservation Division (U. S. Department of the Interior) and Petroleum Administration for War.

[4] By A. H. Redfield, Petroleum Economics Division, Bureau of Mines.

NATURAL GAS [1]

By F. S. Lott and H. Backus

SUMMARY OUTLINE

SUMMARY

The volume of business handled by the natural-gas industry continued to expand to new record levels in 1945, as in other years since 1938. Marketed production is estimated to have increased 4 percent over 1944 to 3,875,172 million cubic feet. All consuming groups consumed more than in 1944, except the miscellaneous industrial classification, which required slightly (3 percent) less gas in 1945, owing to the sharp curtailment of industrial activity after the first quarter of that year.

The most significant effects of lessened use of gas for some industrial purposes, during and after the final stages of the war, were noted in regions dependent, in part at least, upon supplies of gas from remote sources. In these regions many of the transporting companies were able for the first time in 3 years to feel adequately prepared for the stresses of approaching peak winter demands. The segments of industrial consumption that continued to grow to new record volumes in 1945 were: Oil- and gas-field use, carbon-black manufacture, and petroleum-refinery fuel. These types of consumption tend to occur relatively close to gas-producing fields and to have flat seasonal demand curves. They therefore seldom involve complex or costly problems of transport.

The average value of natural gas at the wells was 5.1 cents per thousand cubic feet in 1944 and is thought to have remained unchanged in 1945. Although an upward trend in field values of gas is evident in most producing districts, the United States average has changed very little in recent years because of the growing proportion of gas marketed from southwestern producing States where low well-head values prevail. For example, Texas, Louisiana, and New Mexico increased their share of United States marketed production from 51 percent in 1937 to 58 percent in 1944.

[1] In this report the term "billion" is equivalent to 1,000,000,000 and "trillion" to 1,000,000,000,000, according to United States usage.

The average value of natural gas at points of consumption is estimated to have declined from 21.5 cents per thousand cubic feet in 1944 to 21.2 cents in 1945 (see fig. 1), influenced by lower averages for domestic, commercial, and industrial gas. Domestic and commercial values have been declining for 6 years as average consumption per meter has increased.

The volume of gas exported to Mexico increased from 14,433 million cubic feet in 1944 to about 17,000 million cubic feet in 1945, and the small movement to Canada from New York State increased from 143 million cubic feet to 172 million. No imports of natural gas into the United States have been reported since 1939, when piping of gas from an Alberta field into Montana was discontinued.

Salient statistics of natural gas in the United States, 1941–45

	1941	1942	1943	1944	1945 [1]
Marketed production:					
California .... millions of cubic feet	374,905	403,968	457,757	502,017	510,000
Louisiana .... do	403,855	447,686	505,294	534,688	545,000
Oklahoma .... do	234,054	269,704	285,045	310,888	345,000
Texas .... do	1,086,312	1,170,345	1,323,885	1,525,515	1,680,000
West Virginia .... do	207,681	215,193	223,787	181,452	160,000
Other States .... do	505,851	546,579	618,921	656,479	635,172
Total production .... do	2,812,658	3,053,475	3,414,689	3,711,039	3,875,172
Exports to—					
Canada .... do	121	130	131	143	172
Mexico .... do	7,345	8,572	11,079	14,433	17,000
Consumption:					
Domestic .... do	442,067	498,537	529,444	562,183	605,000
Commercial .... do	144,844	183,603	204,793	220,747	230,000
Industrial:					
Field .... do	686,158	721,063	780,986	855,180	910,000
Carbon-black plants .... do	365,377	335,533	315,562	355,770	431,800
Petroleum refineries .... do	148,127	201,670	243,584	301,026	320,000
Portland-cement plants [2] .... do	54,208	64,540	51,748	35,588	39,200
Other industrial .... do	964,411	1,039,827	1,277,362	1,365,969	1,322,000
Total consumption .... do	2,805,192	3,044,773	3,403,479	3,696,463	3,858,000
Electric public-utility power plants [3] .. do	205,156	238,736	305,576	359,745	326,200
Domestic .... percent of total	16	16	16	15	16
Commercial .... do	5	6	6	6	6
Industrial .... do	79	78	78	79	78
Number of consumers:					
Domestic .... thousands	9,730	10,135	10,354	10,669	10,850
Commercial .... do	767	779	811	845	875
Industrial [4] .... do	43	41	42	43	44
Number of producing gas wells	55,500	56,150	57,200	58,780	(5)
Value (at wells) of gas produced:					
Total .... thousands of dollars	138,508	154,236	176,893	189,809	198,000
Average per M cubic feet .... cents	4.9	5.1	5.2	5.1	5.1
Value (at points of consumption) of gas consumed:					
Domestic .... thousands of dollars	318,093	352,520	370,558	388,359	412,000
Commercial .... do	68,398	80,189	87,648	92,137	95,700
Industrial .... do	233,547	258,458	300,731	313,775	312,000
Total value .... do	620,038	691,167	758,937	794,271	819,700
Average per M cubic feet:					
Domestic .... cents	72.0	70.7	70.0	69.1	68.1
Commercial .... do	47.2	43.7	42.8	41.7	41.6
Industrial .... do	10.5	10.9	11.3	10.8	10.3
Domestic and commercial .... do	65.9	63.4	62.4	61.4	60.8
Domestic, commercial, and industrial .... cents	22.1	22.7	22.3	21.5	21.2
Treated for natural gasoline:					
Quantity .... millions of cubic feet	2,763,300	2,864,400	3,028,000	3,300,000	3,553,000
Ratio to total consumption	99	94	89	89	92

[1] Subject to revision.
[2] Chapters on Cement in Minerals Yearbook.
[3] Federal Power Commission: Figures include gas other than natural, impossible to segregate, therefore shown separately from main table.
[4] Exclusive of oil- and gas-field operators.
[5] Figures not yet available.

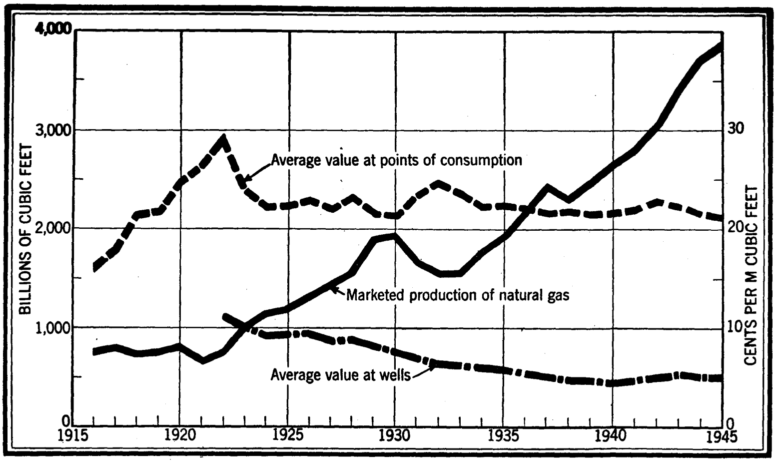

FIGURE 1.—Production and value of natural gas in the United States, 1916–45.

At the end of 1945 the number of domestic meters was about 10,850,000, an increase of 2 percent over 1944 and 47 percent in 10 years. Similarly, commercial meters increased 4 percent over 1944 to about 875,000, a gain of 43 percent in 10 years.

OUTLOOK

The probability of a vigorous growth trend in natural-gas sales during at least the early postwar years, has been more clearly defined by developments of recent months.

Of great potential significance as regards political economy may be the testimony presented before the Federal Power Commission in its natural gas investigation, to which wide publicity was accorded. In the record of natural gas, strong emphasis was placed upon (1) the great and growing magnitude of available reserves; (2) the past record of relatively trouble free service to the public; (3) stable or declining costs to most consumers; (4) opposition of consuming groups to restriction upon supply or utilization; and (5) the great developments anticipated from the fruits of recent research affecting the future, not only of natural gas, but of coal and other fuels.

Wider public appreciation of these factors will tend to strengthen the position of natural gas in competition with other fuels and develop the conditions for sound expansion. Greater demand from consumers in established marketing areas as well as from communities not currently served with natural gas is concretely expressed in numerous projects for expanding facilities for transmission and distribution. An aggregate investment for these purposes of over 150 million dollars of new money is indicated by gas company proposals for the near future.

Recent developments affecting long distance gas transmission indicate that a materially higher efficiency and attendant lower unit cost of operations have been attained than in the past. In delivering southwestern gas to the Appalachian region cost reductions have been possible through using major lines at practically 100-percent load factor and by taking advantage of record low interest rates in financing capital expenditures. As the cost of money is an important element of gas pipe-line expense, the saving from this source has been appreciable. On the other hand, because labor expense represents a relatively small component of the total cost of natural-gas transmission or production, the effect of increased wage scales has been small.

These cost trends have, of course, been improving the competitive position of natural gas, particularly as regards coal with its inherently high labor cost per unit of output and relatively low capital investment. It is well to remember also that price levels in general and wage rates are far above prewar levels and are expected to remain on a "high plateau" indefinitely. The effect of these changes will be more severe upon other fuels than upon natural gas, which, after the "shafts" have been dug, practically "mines itself" in condition for market.

It is often said that technology has caused the world to shrink drastically in recent years. Similarly, the economic and physical barriers to long-distance gas transmission have crumbled rapidly, and markets have thereby been brought significantly closer to major sources of supply.

LAW AND ADMINISTRATION

Unusually cold weather in the first days of February 1945 caused a crisis in gas supply in the Appalachian region. The Office of War Utilities, a division of the War Production Board, appealed to all consumers of natural gas to curtail their use of gas during the emergency, supplies of many war plants were cut off, and restrictions were placed upon heating of places of amusement, schools, libraries, and similar establishments. These measures were taken to prevent a collapse of gas pressures in the major pipeline networks, which would have seriously delayed the war effort and caused great public loss and suffering. The curtailment orders were in force February 2 to 5, inclusive, and were reinstated during a second cold spell on February 19 to 21.

As a result of these experiences, top priorities were authorized for two major pipe-line construction projects to bring an additional 110 million cubic feet daily of gas from southwestern producing States to the eastern industrial area.

A comprehensive investigation of the natural-gas industry was conducted by the Federal Power Commission in a series of eight public hearings in the late months of 1945 and early 1946. Voluminous testimony was placed in the record by witnesses for the industry, State and local governments, consumers, competing fuel and transportation interests, and the Federal Government. It is understood that a report of findings will be submitted by the Commission to the Congress early in 1947.

HISTORY OF GAS STATISTICS

A discussion of the nature and development of Bureau of Mines statistics on the production and use of natural gas was presented at the final hearing before the Federal Power Commission in June 1946. Because it is believed this discussion will interest and assist users of the gas data in the long series of Natural-Gas chapters in the Minerals

Yearbooks and preceding Mineral Resources volumes, most of it is reproduced here.

The primary purposes of the statistics on natural gas compiled by the Bureau of Mines are to measure the quantities produced and utilized, by States and the United States, and to indicate the corresponding dollar values.

Basic data are obtained from operators in the industry who report the required information on annual questionnaire forms and mail them direct to the Bureau of Mines. Effective participation by the industry involves considerable effort and expense and is essential to the success of the project. This cooperation of the industry and Government is logical because it produces information of recognized value to each and to the general public.

The year 1906 may be regarded as the birthdate of natural-gas statistics, for in that year an effective measure of the volume of natural gas produced and utilized in the United States was developed by the Geological Survey. Its canvass of the industry was the first in which comprehensive volume data were reported. In earlier years only the value of gas at points of consumption was recorded, or its value in terms of the cost of coal, wood, or other equivalent fuel displaced.

The business of selling natural gas for fuel was carried on for a number of years before a satisfactory means was devised for measuring large movements of gas through pipe lines. Hence, in this period statistics of actual volume were unobtainable. The nearest approach to such statistics for years before 1906 was probably the calculated estimates of production made by F. G. Tryon, formerly with the Geological Survey and later with the Bureau of Mines. These were based upon contemporary estimates of the quantity of coal displaced by gas or of the value of the gas sold and they covered annually the period from 1882 to 1905, inclusive.[2]

The 1906 survey provided statistics, by States, of the volume of production and consumption of natural gas, the number of consumers, and the values at points of consumption. It was noted in the first report that many producers kept no record of the quantity of gas produced, and this rendered the collection of a complete record of production very difficult. However, most of the gas marketed by small producers was, and is today, sold to larger organizations for transport to markets.

As a result of this situation, an indirect approach to production figures was developed. After the data of consumption had been organized as a starting point, the movement of gas was traced backward through intercompany receipts and deliveries to its point of origin. In this way, much of the production for which no adequate reports from producers could be obtained was traced to its source through transporting-company reports and credited to the proper producing area. Through this procedure, the figure obtained for production represents essentially the amount of gas usefully consumed and has been termed "marketed production." It does not measure the total volume of gas withdrawn from natural reservoirs for it takes no account of losses and waste. For most individual States, marketed production and consumption differ over wide limits because of the

[2] Burns, A. F., Production Trends in the United States: Nat. Bureau of Econ. Research, 1934, p. 292.

extensive transportation of gas across State lines; for the United States as a whole, however, they differ only by the small net balance of trade with Mexico and Canada.

The indirect method has been an essential tool in the compilation of natural-gas statistics through the years. Although, under present operating conditions, gas usually is metered at some point near the producing wells, a complete annual coverage of production from producers' reports has not been feasible, for a canvass of the several thousand small, scattered units engaged in production involves heavy expense and has not in the past produced a complete coverage because a minority failed to report.

As the industry grew in economic stature and geographic extent, its activities commanded wider interest that was often expressed in requests to the Bureau of Mines for more, or new types of, statistical information. Compilation of the natural-gas and other mineral statistics was transferred by Executive order from the Geological Survey to the Bureau of Mines on July 1, 1925. Hence, the Bureau figures reflected these demands as facilities would permit, increasing in scope and, from time to time, adding to the detailed information shown. At the beginning, consumption of natural gas comprised two classes, domestic and industrial. In later years, the industrial class was successively divided by industry groups into the present six parts. The domestic class, which had included such consumers as stores, theaters, cleaning plants, and the like, was divided in 1930 into two parts. The new domestic class was limited to dwellings or household consumers, and the remainder were designated commercial consumers. These changes enhanced the usefulness of the gas statistics by providing specific yardsticks for measuring segments of the market.

The importance of interstate gas transportation was indicated in 1921 with publication of a table defining these movements, by State of production and State to which piped. These operations have increased about sevenfold since 1921, and the table has expanded to include States traversed by long-distance transportation and those to which service to consumers has since been extended.

Before 1922 published values of natural gas referred to values at points of consumption and therefore reflected all costs from the producing fields to points of delivery to consumers. A value of gas production at the wells was first compiled for 1922 and provided an index of the producers' average realization for their product in the field.

The number of consumers of natural gas mixed with manufactured gas increased very rapidly after 1930, as a result of the growth in long-distance gas transmission through major pipe lines built in the 1925–32 period. Many of the market areas to which natural gas was made available for the first time had been served with manufactured gas, and distributing companies often chose to use natural gas as an agent of enrichment for manufactured gas rather than to convert to 100-percent or "straight" natural gas. Beginning with 1931, the Bureau of Mines published data indicating, by States, the quantity of natural gas mixed for consumption with manufactured gas, the corresponding numbers of domestic and commercial consumers, and the value of natural gas consumed. These data are included in the general tables of consumption of natural gas. They provide a means of segregating straight natural-gas consumption for those who may desire this information.

Beginning with 1935, an attempt was made to indicate more completely than in the past the order of magnitude of total withdrawals of natural gas from reservoirs. A table was compiled under the title, "Gross production of natural gas in the United States, by States," in which the difference between marketed production, as published for many years by the Bureau of Mines, and estimated gross production was shown.

Gross production was estimated by summation of four columns: Marketed production, gas used for repressuring, gas stored underground, and losses and waste. In compiling the last column, information from reports to the Bureau of Mines was supplemented by available data from State, Government, industry, and other sources deemed to be reliable. Because of the lack of complete information on gas withdrawals in many producing areas, the estimate of gross production must be regarded as a conservative approximation of actual output that probably does not include significant volumes of gas produced in some States. The gas shown as used for repressuring and stored in the ground is returned to underground reservoirs and is therefore generally available as a reserve for future use. In separating gross production by source between gas wells and oil wells, condensate wells have been classed as gas wells.

The natural-gasoline and carbon-black industries are, of course, closely related to natural gas, which is the raw material from which the products of both are derived. The Bureau of Mines compiles and publishes statistics of production and primary distribution for these two industries. Data from producers, particularly in the natural-gasoline group, interlock with information reported by the natural-gas companies at many points where the gas is transferred from one type of property to another. Thus, a cross check of many transactions can be made to improve the accuracy of the gas figures.

It may be proper here to mention two problems common to the production of most statistical information, because they have been mentioned frequently in recent years with reference to the natural-gas data compiled by the Bureau of Mines. The first is: What should be the time interval between statistical benchmarks? The Bureau's gas data have been on an annual basis for over 40 years. The second is: To what degree should the statistics be classified to show segments of supply, or distribution and use? The trend toward more detailed classification of the gas statistics has been sketched briefly above, as they have been adapted to a progressively broader field of usefulness.

These two problems have no final solutions; but it has been the purpose of the Bureau of Mines, in its natural-gas statistics, so far as possible, to provide dependable information of a character to reflect current needs of industry and government. It is evident that interest in all phases of the natural-gas industry has greatly increased since the end of hostilities last year, and the importance of natural gas is recognized more widely than ever before. A desire for more complete monthly natural-gas data has been expressed in the southwestern producing States, and in other quarters a need is felt for more complete segregation of natural-gas consumption. These inquiries are a natural result of analysis and study of available information on gas, through which the limitations as well as the utility of the data are revealed.

GROSS PRODUCTION

The gross withdrawal of natural gas from gas and oil wells is estimated to have increased from the revised total of 5,160,560 million cubic feet in 1943 to 5,614,220 million in 1944 (9 percent), of which about half was from Texas fields. Principal gains were in the leading States—Texas, Louisiana, and California. Material declines in New

Gross production and disposition of natural gas in the United States, 1943–44, by States, in millions of cubic feet

State	Estimated production [1]			Estimated disposition			
	From gas wells	From oil wells	Total	Marketed production	Repressuring	Stored in ground (net)	Losses and waste [2]
1943							
Arkansas	29,000	30,000	59,000	36,469	8,775	98	13,658
California	155,000	400,000	555,000	457,757	73,275	6,113	17,855
Colorado	6,000	1,000	7,000	6,445	273		282
Illinois	1,300	62,700	64,000	18,120	5,866	905	39,109
Indiana	1,100	1,300	2,400	1,450	499		451
Kansas	98,000	52,000	150,000	133,729	2,099	[3] 1,325	13,513
Kentucky	92,000	10,000	102,000	92,364	625		8,971
Louisiana	515,000	185,000	700,000	505,294	91,144	58	103,504
Michigan	21,300	1,700	23,000	18,006		3,226	1,768
Mississippi	1,350	1,450	2,800	1,461			1,339
Missouri	130	10	140	124			16
Montana	30,500	1,500	32,000	31,562	35		403
New Mexico	41,000	125,000	166,000	86,500	3,204		76,296
New York	9,300	100	9,400	8,062		[3] 639	1,163
Ohio	58,500	4,500	63,000	52,001	3,495	[3] 1,608	7,184
Oklahoma	[4] 179,000	163,000	[4] 342,000	285,045	14,020	1,113	[4] 41,471
Pennsylvania	97,500	5,500	103,000	93,543	1,335	[3] 708	7,068
Texas	1,630,000	[4] 850,000	[4] 2,480,000	1,323,885	600,773	1,327	[4] 553,700
West Virginia	232,000	11,000	243,000	223,787	5,428	[3] 45	12,374
Wyoming	24,000	28,000	52,000	34,351	13,957	1,788	1,904
Other States [5]	4,800	20	4,820	4,734			86
Total	[4] 3,226,780	[4] 1,933,780	[4] 5,160,560	3,414,689	824,803	18,953	[4] 902,115
1944							
Arkansas	44,000	38,000	82,000	46,453	10,520	171	24,856
California	187,000	430,000	617,000	502,017	85,000	3,785	26,198
Colorado	5,000	1,000	6,000	5,141	453		406
Illinois	1,000	54,000	55,000	18,137	8,500	382	27,981
Indiana	900	1,200	2,100	1,014	674	145	267
Kansas	118,000	48,000	166,000	157,733	2,206	[3] −401	12,417
Kentucky	93,000	10,000	103,000	94,223	700	−400	8,228
Louisiana	609,000	191,000	800,000	534,688	116,771		148,541
Michigan	21,000	4,000	25,000	19,653		1,123	4,224
Mississippi	1,000	1,700	2,700	1,352			1,348
Missouri	160	10	170	159			11
Montana	31,300	1,700	33,000	32,102	25		873
New Mexico	30,000	104,000	134,000	87,727	2,860	104	43,309
New York	7,440	260	7,700	7,052	60	[3] 2	578
Ohio	53,000	4,000	57,000	51,724	6	[3] 3,196	6,533
Oklahoma	218,000	147,000	365,000	310,888	15,919	2,111	32,057
Pennsylvania	95,000	5,000	100,000	92,987	1,436	[3] 993	6,676
Texas	1,908,000	889,000	2,797,000	1,525,515	624,000		643,751
West Virginia	194,500	9,500	204,000	181,452	1,607	[3] −1,556	18,007
Wyoming	26,000	25,000	51,000	34,521	12,242	262	3,975
Other States [5]	6,530	20	6,550	6,501			49
Total	3,649,830	1,964,390	5,614,220	3,711,039	882,979	9,917	1,010,285

[1] Marketed production plus quantities used in repressuring, stored in ground, lost, and wasted (see footnote 2).
[2] Includes gas (mostly residue gas) blown to the air and transportation losses but does not include direct waste on producing properties, except where data are available.
[3] Includes gas transported from other States.
[4] Revised figures.
[5] Florida, North Dakota, South Dakota, Tennessee, Utah, and Virginia.

Mexico and Illinois were related to smaller gas production from oil wells. In West Virginia withdrawals from gas wells were reduced from the unusually high rates of 1943.

Growing concern, on the part of State officials and the industry, with regard to waste of oil-field gas caused the procurement and publication, particularly in Texas, of more complete data on these activities than had been available in the years before 1943. Hence, the indication of an upward trend in losses and waste in 1943 and 1944 is largely the result of more complete coverage in those years. The actual trend has been obscured to an indeterminate degree.

Storage of gas in natural reservoirs below ground decreased in 1944 to 9,917 million cubic feet (net) from 18,953 million in 1943 as withdrawals to meet peak loads more nearly balanced summer input. In three States—Kansas, Kentucky, and West Virginia—heavy winter requirements caused a net reduction in the quantity of gas in storage reservoirs.

MARKETED PRODUCTION

In 1944 the marketed production of natural gas reached a record volume of 3,711,039 million cubic feet, 9 percent above 1943. Texas supplied the largest gain in output (202 billion cubic feet) over 1943 and by so doing increased its share of United States marketed production from 38.8 to 41.1 percent. West Virginia production dropped sharply (19 percent) to the lowest level since 1939.

Although the average value at the wells declined to 5.1 cents per thousand cubic feet in 1944 from 5.2 cents in 1943, it is interesting to observe that this average declined in only three States of large production—California, Montana, and Michigan. States in which the average value of gas at the wells was less than 5.0 cents produced 70 percent of the total marketed production in 1944 compared with 72 percent in 1943.

Natural gas produced in the United States and delivered to consumers, 1940–44, by States, in millions of cubic feet

Year	Arkansas	California	Colorado	Illinois	Indiana	Kansas	Kentucky	Louisiana	Michigan	Mississippi	Montana	New Mexico
1940	14,379	351,950	2,533	8,359	1,137	90,003	53,056	343,191	12,648	6,365	26,231	63,990
1941	19,148	374,905	3,256	10,053	1,522	111,121	69,067	403,855	13,916	4,268	28,499	64,655
1942	19,456	403,968	4,865	14,484	1,599	112,921	80,089	447,686	15,521	2,082	31,475	78,164
1943	36,469	457,757	6,445	18,120	1,450	133,729	92,364	505,294	18,006	1,461	31,562	86,500
1944	46,453	502,017	5,141	18,137	1,014	157,733	94,223	534,688	19,653	1,352	32,102	87,727

Year	New York	Ohio	Oklahoma	Pennsylvania	Texas	West Virginia	Wyoming	Other States	Total	Value at points of consumption: Total (thousands of dollars)	Value at points of consumption: Average per M cubic feet (cents)
1940	12,187	40,639	257,626	90,725	1,063,538	188,751	27,346	5,568	2,660,222	577,939	21.7
1941	10,456	41,858	234,054	92,819	1,086,312	207,681	29,284	5,929	2,812,658	621,333	22.1
1942	8,718	45,055	269,704	93,532	1,170,345	215,193	33,124	5,494	3,053,475	692,737	22.7
1943	8,062	52,001	285,045	93,543	1,323,885	223,787	34,351	4,858	3,414,689	760,950	22.3
1944	7,052	51,724	310,888	92,987	1,525,515	181,452	34,521	6,660	3,711,039	797,255	21.5

Natural gas produced and consumed in the United States in 1944, by States

State	Produced and delivered to consumers, including deliveries in other States						Consumed, including receipts from other States			
	Quantity		Estimated value at wells		Value at points of consumption		Quantity		Value at points of consumption	
	Millions of cubic feet	Percent of total	Total (thousands of dollars)	Average per M cubic feet (cents)	Total (thousands of dollars)	Average per M cubic feet (cents)	Millions of cubic feet	Percent of total	Total (thousands of dollars)	Average per M cubic feet (cents)
Alabama							44,323	1.2	9,846	22.2
Arizona							23,908	.6	6,915	28.9
Arkansas	46,453	1.3	1,222	2.6	5,824	12.5	94,783	2.6	11,892	12.5
California	502,017	13.5	32,330	6.4	133,484	26.6	502,017	13.6	133,484	26.6
Colorado	5,141	.1	246	4.8	1,311	25.5	33,101	.9	11,023	33.3
District of Columbia							6,782	.2	4,721	69.6
Florida	6	(1)	(2)	3.0	(2)	3.0	6,545	.2	1,294	19.8
Georgia							35,603	1.0	11,827	33.2
Illinois	18,137	.5	1,128	6.2	2,942	16.2	123,325	3.3	50,620	41.0
Indiana	1,014	(1)	89	8.8	794	78.3	38,581	1.0	17,563	45.5
Iowa							27,307	.7	10,146	37.2
Kansas	157,733	4.3	8,297	5.3	55,613	35.3	143,814	3.9	28,499	19.8
Kentucky	94,223	2.5	14,426	15.3	40,392	42.9	24,399	.7	10,498	43.0
Louisiana	534,688	14.4	18,019	3.4	88,660	16.6	310,127	8.4	31,567	10.2
Maryland							2,491	.1	1,815	72.9
Michigan	19,653	.5	2,417	12.3	14,059	71.5	56,077	1.5	44,437	79.2
Minnesota							35,229	.9	11,299	32.1
Mississippi	1,352	(1)	71	5.3	336	24.9	33,111	.9	8,287	25.0
Missouri	159	(1)	14	8.8	84	52.8	65,046	1.8	26,551	40.8
Montana	32,102	.9	1,486	4.6	8,248	25.7	29,019	.8	7,134	24.6
Nebraska							24,699	.7	8,657	35.1
New Mexico	[3] 87,727	2.4	1,333	1.5	13,980	15.9	55,284	1.5	6,214	11.2
New York	[4] 7,052	.2	1,812	25.7	5,164	73.2	27,057	.7	20,151	74.5
North Dakota	200	(1)	6	3.0	65	32.5	2,267	.1	880	38.8
Ohio	51,724	1.4	9,171	17.7	26,783	51.8	166,785	4.5	87,003	52.2
Oklahoma	310,888	8.4	11,347	3.6	46,346	14.9	249,996	6.8	29,844	11.9
Pennsylvania	[5] 92,987	2.5	22,298	24.0	45,542	49.0	148,675	4.0	62,439	42.0
South Dakota	5	(1)	(2)	4.4	2	40.0	7,688	.2	2,499	32.5
Tennessee	10	(1)	1	10.0	5	50.0	24,693	.7	7,237	29.3
Texas	[6] 1,525,515	41.1	38,290	2.5	223,800	14.7	1,221,383	33.0	95,976	7.9
Utah	6,223	.2	285	4.6	1,535	24.7	20,275	.5	5,000	24.7
Virginia	57	(1)	6	10.5	56	98.2	1,694	(1)	1,499	88.5
West Virginia	181,452	4.9	24,169	13.3	74,743	41.2	88,953	2.4	23,605	26.5
Wyoming	34,521	.9	1,346	3.9	7,487	21.7	21,426	.6	3,849	18.0
Total: 1944	3,711,039	100.0	189,809	5.1	797,255	21.5	3,696,463	100.0	794,271	21.5
1943	3,414,689	100.0	176,893	5.2	760,950	22.3	3,403,479	100.0	758,937	22.3

1 Less than 0.05 percent.
2 Less than $500.
3 Includes 1,474 millions of cubic feet piped to Mexico.
4 Includes 31 millions of cubic feet piped to Canada.
5 Includes 112 millions of cubic feet piped to Canada.
6 Includes 12,959 millions of cubic feet piped to Mexico.

WELLS

Gas-well completions numbered 3,227 in 1945, compared with 3,069 in 1944. Gas development in southwestern fields was greatly stimulated by heavy demand, particularly from the long-distance transmission systems. On the other hand, drilling in the Appalachian region declined, apparently under the influence of increasing costs and the scarcity of undeveloped but high-grade productive acreage, such as the Oriskany sand fields provided for a few years. In the 5 Appalachian States 20 percent fewer gas wells (426) were completed in 1945, and in 5 southwestern producing States 94 percent more gas wells (628) were completed. Remarkable gains in Texas and Kansas reflected intensive development of the Panhandle, Carthage, and Hugoton areas.

The total number of producing gas wells increased by 1,580 during 1944 to 58,780 on December 31. In all, 1,489 gas wells were abandoned or shut in.

Gas wells in the United States, 1943–45, by States

State	Producing Dec. 31, 1943	Drilled during 1944 [1]	Producing Dec. 31, 1944	Drilled during 1945 [1]
Arkansas	190	2	180	------------
California	170	50	200	56
Colorado	20	1	20	1
Illinois	80	6	80	1
Indiana	950	28	810	28
Kansas	1,990	93	2,040	201
Kentucky	[2] 2,850	305	[2] 3,090	221
Louisiana	1,790	82	1,820	108
Michigan	560	64	630	54
Mississippi	20	1	20	------------
Missouri	110	5	110	4
Montana	500	81	580	49
New Mexico	120	9	130	21
New York	2,000	5	1,990	7
Ohio	6,900	480	6,950	404
Oklahoma	2,330	212	2,450	250
Pennsylvania	18,600	725	19,000	520
Tennessee	(2)	1	(2)	------------
Texas	3,560	270	3,800	714
West Virginia	14,310	640	14,720	577
Wyoming	120	7	130	10
Other States [3]	30	2	30	1
	57,200	3,069	58,780	3,227

[1] From Oil and Gas Journal and State sources.
[2] Tennessee included with Kentucky.
[3] North Dakota, South Dakota, Utah, and Virginia.

TECHNOLOGIC DEVELOPMENTS

Commercial-scale production of liquid and solid products from dry natural gas by chemical synthesis techniques moved a step closer to realization with the projection of a large plant near Brownsville in south Texas. Construction of the plant, which will cost about $20,000,000, is scheduled to begin early in 1947. With availability of natural gas on a long-term basis at 5 cents or less a thousand cubic feet, it is confidently believed that production costs will be at competitive levels with products obtained from crude petroleum.

Adaptations of the process may open interesting prospects also to the producers of coal and manufactured gas. It has been stated that a 1,000-B. t. u. gas may be made from coal at costs not far above those for producing an equivalent quantity of manufactured gas, on a heat unit basis, by conventional methods.

It is apparent that the efficiency of long-distance gas transmission has increased notably in recent years, with attendant savings in the unit cost of gas moved. Perhaps the best example of coordinated activities on a broad scale for the most advantageous use of varied facilities is the arrangement by which gas from Texas is integrated into the supply-demand balance of the Appalachian region. Seasonal fluctuations in demand for natural gas are effectively met by extensive use of underground storage and control of local production in a manner to permit full utilization of capacity to transport southwestern gas into the region.

In a number of market areas, supplemental installations for meeting peak-load gas requirements with liquefied petroleum gases have been constructed in the last 2 years. This type of equipment is expected to add significantly to markets for these liquid products.

A more systematic and comprehensive coverage than in the past of the reserves of natural gas in the United States is promised by plans of the American Gas Association. A Committee on Natural-Gas Reserves has been organized to present estimates annually of the magnitude of reserves of natural gas and, in cooperation with the American Petroleum Institute, the quantity of recoverable hydrocarbon liquids associated therewith.

REVIEW OF DEVELOPMENTS, BY STATES

Arkansas.—Data from L. L. Jordan, Arkansas Oil and Gas Commission, indicate that gas production from controlled fields in south Arkansas declined from 61,028 million cubic feet in 1944 to 58,085 million in 1945, and output of uncontrolled fields declined from 14,809 to 11,824 million cubic feet. Output of the dry-gas fields in the northwestern district increased from 4,830 million cubic feet to 5,132 million.

The only gas discovery in 1945 was the Bloomer field on the Big Creek anticline in northern Sebastian County. The discovery well encountered gas in the Atoka formation at 2,730 feet, with initial rock pressure of 250 pounds and open flow capacity of 431,000 cubic feet. Five gas wells completed in the White Oak field, Franklin County, extended the productive area 3 miles to the southwest and 1 mile to the north and opened a new gas sand below (3,600 feet) the older producing horizons (3,000 feet and less).

The Columbia and Texarkana pools remained shut-in during 1945 for lack of a market. These gas deposits in southwest Arkansas contain a high percentage of nitrogen.

An active campaign of leasing for oil and gas was conducted in southeastern Arkansas.

California.—According to a report of the California Railroad Commission, supplied by E. F. McNaughton, the natural-gas reserves of California, as of January 1, 1946, approximated 11.4 trillion cubic feet, of which 6.8 trillion were oil-well gas and 4.6 trillion dry gas. The Rio Vista field is credited with 3.5 trillion of the dry-gas total.

Extensions of the Rio Vista and Kirby Hills fields were reported, in addition to discovery of the Cache Slough field 1¼ miles north of the nearest Rio Vista well but separated from it by two dry holes. A well at Maine Prairie produced 7 million cubic feet of gas from 4,790 feet to open a new area or an extension to the Millar field north of it.

The capacity to deliver gas from the storage reservoirs at La Goleta and Playa del Ray was materially increased in 1945 to aid further in meeting winter peak demands.

Data furnished by R. M. Bauer, Southern California Gas Co., indicate that gas production in 1945 totaled 554,486 million cubic feet (a gain of 1 percent over 1944), exclusive of 93,030 million cubic feet used for repressuring. Of the total, 187,846 million cubic feet were produced from dry-gas pools, including 159,580 from Rio Vista. Dry-gas production in California has increased rapidly in recent years to a cumulative total to January 1, 1946, of 980 billion cubic feet.

Colorado.—No gas discoveries and only one new gas well (at Powder Wash) were indicated in a report from J. R. Schwabrow, Geological Survey, United States Department of the Interior, Casper, Wyo. Two oil wells, however, were recompleted as gas wells in the Powder Wash field, with an initial capacity of about 16 million cubic feet a day.

The pressure-maintenance plant in the North McCallum field in 1945 handled 11 billion cubic feet of carbon dioxide gas not included in natural-gas statistics. About 58 percent of this gas was returned to the oil-producing sand, 31 percent lost, and 11 percent used in dry-ice manufacture.

About 400 million cubic feet of natural gas were produced with oil at Rangely and 560 million at Wilson Creek in 1945, part of which was used in the field and the balance lost to the air. In the Hiawatha field 513 million cubic feet of gas were returned to oil sands for pressure maintenance.

Marketed production continued to decline to 4,247 million cubic feet in 1945 from 4,872 million in 1944. Production, by fields, in millions of cubic feet, in 1945 was: Hiawatha 2,355, Powder Wash 1,616, Thornburg 234, Berthoud 39, and Craig 2.

Illinois.—Gas data for 1945 are taken from a report by Alfred H. Bell and Virginia Kline of the Illinois State Geological Survey.

Although more than 1,000 oil wells were drilled, no gas-well completion was reported. Total gas production is estimated at 50 billion cubic feet in 1945, of which only 477,600,000 cubic feet were dry gas, from the Russellville and Ayers gas fields and from gas wells in the Louden oil field.

The gas produced from oil wells is largely unmetered, and therefore information as to its utilization is estimated. Approximately 21 billion cubic feet of gas were processed at natural-gasoline plants. Over half of 15 billion cubic feet of residue gas was returned to oil sands and about 5 billion were used in oil-field operations. Of the Louden field residue gas, 578 million cubic feet were sold for distribution to domestic and commercial consumers. Over half of the casinghead gas produced in fields with no processing plants is estimated to have been used in the oil fields and a small amount injected into producing sands.

Indiana.—A report by Charles F. Deiss and A. C. Colby, State geologist, and assistant, respectively, of Indiana, states that three gas pools were discovered in 1945: The French pool in Spencer County, Friendship in Ripley County, and Oliver in Posey County.

Gas-well completions increased from 28 in 1944 to 36 in 1945, of which 11 were in Decatur County, 6 in Jay, 5 in Rush, and 4 in Harrison.

Production in the old Trenton field, scattered over 20 counties, was estimated in 1945 at about 37 million cubic feet. The output of other fields was not shown.

Kansas.—A report by Doris Bush Leonard, geologist, Kansas Geological Survey, and a letter from L. B. Taylor, State Corporation Commission, supplied the following information:

Completion of 215 gas wells in 1945 was reported, of which 181 were in the Hugoton field, anticipating future increased pipe-line takings. Although only 7 of the total were indicated for eastern Kansas, more were doubtless drilled but not reported.

Gas production declined to 124,100 million cubic feet in 1945 from 134,703 million in 1944. Principal fields produced as follows, in millions of cubic feet: Hugoton 80,705, Medicine Lodge 13,656, Otis 6,022, Cunningham 3,423, and eastern Kansas (estimated) 5,130.

Six gas discoveries were made in 1945, among which the Adams Ranch pool, Meade County, was the most important. The other discoveries were: Fairmont in Leavenworth County, Medicine Lodge Northeast pool in Barber, Dundee pool in Barton, Shady pool in Pawnee, and Loretta in Rush.

Kentucky.—Gas-well completions numbered 229 in 1945, of which 218 were in eastern Kentucky fields, 5 in western, and 6 in south central Kentucky.

Only one gas discovery was reported. A well near Hyden, Leslie County, tested 133,000 cubic feet of gas initially from "Big 6" sand of Silurian age at about 2,790 feet. Closest production is in the Oneida gas pool in Clay County, 17 miles to the northwest. In the latter field 8 gas wells producing from the "Big 6" sand were drilled in 1945.

Louisiana.—Completions of gas and condensate wells increased from 82 in 1944 to 147 in 1945, of which 85 were in the Northern district and 62 in the Gulf district.

The discovery of one dry-gas and eight condensate fields was reported. Northern Louisiana discoveries were as follows: Chatham in Jackson Parish (dry gas), East Haynesville in Claiborne, Knowles in Lincoln, Sicily Island in Catahoula, Southwest Delhi in Franklin, and Vixon in Caldwell. In south Louisiana three condensate fields were opened to production from sands of Miocene age: Houma in Terrebonne Parish, Mud Lake in Cameron, and Weeks Island in Iberia. The latter produced at the record depth for condensate production of 13,505 feet.

Casinghead-gas production decreased 6 percent below 1944 to 178,690 million cubic feet, and gas production from gas and condensate wells increased about 1 percent to 617,456 million cubic feet.

Michigan.—According to F. R. Frye, Michigan Department of Conservation, 63 gas wells were completed in 1945 compared with 64 in 1944. The discovery of 8 gas fields and 4 new producing formations was reported in 1945. None of these, however, appeared to be of major size; therefore, added reserves may not have offset withdrawals during the year.

Total gas production in 1945 increased about 10 percent over 1944 to 23,299 million cubic feet.

The Marion and Cranberry Lake gas fields were purchased for use as gas-storage facilities.

Mississippi.—Information from H. M. Morse, supervisor, Mississippi State Oil and Gas Board, is the basis of the following summary.

Total gas production in 1945 was 8,354 million cubic feet from 18 fields, led by Cranfield with 3,783 million cubic feet, Gwinville with

1,331 million, Jackson with 632 million and Baxterville with 618 million.

A conservative estimate of gas reserves indicated 860 billion cubic feet as of January 1, 1946, of which about 75 billion is oil-field gas. The largest reserves, in billions of cubic feet, were at Cranfield 442, Gwinville 259, and Baxterville 103.

Missouri.—Seventeen gas wells were drilled in Missouri in 1945, according to a report from Frank C. Greene, Missouri Geological Survey. Several were shallow private wells drilled by farmers in the New Ballard area, Bates County. Gas completions by counties were: Bates 7, Cass 3, Jackson 4, and Platte 3.

Production in 1945 was 77.6 million cubic feet from 36 commercially produced gas wells.

Montana.—Information in a report from J. R. Schwabrow, Geological Survey, Casper, Wyo., indicates that 49 gas wells were completed in 1945 compared with 81 in 1944. The gas completions were distributed by fields as follows: Bears Den 1, Bowdoin 6, Cedar Creek 11 (not including 7 in North Dakota), Cut Bank 9, Devon 8, Hardin 8, Kevin-Sunburst 5, and Whitlash 1.

No discoveries were reported. The Marias River field was abandoned in August 1945 after less than 2 years of production.

Production by leading fields, in millions of cubic feet, was: Bowdoin 5,067, Cedar Creek 5,375, Cut Bank 14,730, Dry Creek 1,149, Kevin-Sunburst 2,282. Marketed production decreased from 31,549 million cubic feet in 1944 to 31,064 million in 1945, exclusive of 1,100 million used in field operations.

New Mexico.—Information on developments has been supplied by Foster Morrell, supervisor, Geological Survey, Roswell, N. Mex.

Gas completions in 1945 in southeast New Mexico were six in Lea County and four in Eddy County. No large gas reserves were discovered, but the Sims No. 1 well in sec. 24, T. 22S, R. 37 E., Lea County, which opened production from the Upper Yeso formation at 5,460 feet, may be potentially important.

In northwestern New Mexico, 11 gas completions were reported (all in San Juan County), and 2 discoveries were made. An important gas reserve was indicated in the Paradox formation (Pennsylvania) by Ute No. 1 well, which made 42 million cubic feet of gas initially from 8,420 to 8,650 feet. A discovery, of perhaps minor importance, was made 3 miles east of the Kutz Canyon gas field in the Farmington sand at 1,350 feet.

Production in the southeastern district amounted to 108.7 billion cubic feet in 1945, of which 105.3 were processed at gasoline plants. Residue gas from these plants was distributed as follows: Domestic, commercial, and miscellaneous industrial, 44.1 billion cubic feet; carbon-black manufacture, 16.1 billion; plant and lease fuel, 9.9 billion; shrinkage, 7.1 billion; vented at plants, 23.9 billion; returned to oil reservoirs, 2.8 billion.

New York.—Of 20 wells drilled in 1945, mostly to the Oriskany sand, 7 were gas producers with a total daily open-flow capacity of 64 million cubic feet, according to information from E. T. Heck, geologist, New York State Museum. Six of the seven producers were in the Tuscarora Township pool, Steuben County, mentioned in the preceding gas chapter as a 1944 discovery.

The seventh gas well was completed in Independence Township, Allegany County, with a flow of 8 million cubic feet from Oriskany sand at 4,746 feet.

A deep test well in Arcade Township, Wyoming County, found small shows of gas at 6,030 and 6,182 feet, salt water at 6,391 feet. It had reached 7,126 feet in March 1946.

North Dakota.—Gas production increased from 200,105,000 cubic feet in 1944 to 216,733,000 cubic feet in 1945, according to a report from Wilson M. Laird, State geologist, Grand Forks, N. Dak.

All production was from 13 small gas wells on the southeastern part of the Cedar Creek anticline, Bowman County. Seven of these were drilled in 1945.

Ohio.—During 1945, about 7,000 acres were added to new gas pools, according to a report by Kenneth C. Cottingham, chief geologist, Ohio Fuel Gas Co., Columbus, Ohio. Clinton sand discoveries were reported in Lorain, Stark, Coshocton, Perry, and Ashland Counties; and an Oriskany-sand wildcat produced 3.9 million cubic feet initially from a depth of 3,632 feet in Goshen Township, Mahoning County.

Gas-well completions declined from 478 in 1944 to 429 in 1945, of which 247 were Clinton-sand, 89 Berea-sand, 55 shallow-sand, and 24 Oriskany-sand producers.

Natural-gas production amounted to 51,724 million cubic feet in 1944 and is estimated to have declined to about 47,000 million in 1945.

Oklahoma.—The following information is taken from a report by Elmer Capshaw, gas engineer, Oklahoma Corporation Commission, and other sources.

Although no major gas reserves were proved in 1945, the discovery of two condensate fields—Chitwood in Grady County and Bethany in Oklahoma County—suggests the probability of important additions with further development.

Gas-well completions numbered 277, of which 15 were reported as discoveries. Drilling for gas was most active in the Guymon-Hugoton area in Texas County, where 110 wells were drilled with average open-flow potentials of 15 million cubic feet each per day. The Oklahoma portion of this great field had 215 producing gas wells at the end of 1945.

Gas production increased 44.2 billion cubic feet in 1945 to 385.9 billion, of which 244.3 billion were dry gas and 141.6 billion from oil wells. New processing facilities permitted greatly increased marketing of casinghead gas from West Edmond and Crescent oil fields in the form of residue from natural-gasoline plants. Withdrawals from the Guymon-Hugoton area increased from 42.1 billion cubic feet in 1944 to 85.4 billion in 1945, nearly all of which was piped to other States. Consumption of natural gas within Oklahoma is thought to have declined in 1945 less than had been anticipated.

Pennsylvania.—Information from J. G. Montgomery, Jr., vice president, United Natural Gas Co., indicates that in 1945, 691 wells were drilled for gas in shallow sands. Of these, 292 were completed as gas wells in southwestern Pennsylvania, with total capacity of 99.7 million cubic feet, and 228 in the northern and middle districts, with a total capacity of 49.0 million cubic feet.

Ten deep tests failed to find new gas reserves. Dry holes through the Medina sands were drilled in Elk, McKean, Warren, and Mercer Counties. Oriskany sand failures were drilled in Washington (two), Fayette, and Erie Counties. A test in Worth Township, Mercer County, encountered salt water in dolomite (Beckmantown) below the Trenton limestone. Nine wells to test lower horizons were drilling at the year end.

Gas production was 92,987 million cubic feet in 1944 and is estimated to have declined to about 82,000 million in 1945.

South Dakota.—About 9,937,000 cubic feet of gas were produced at Pierre in 1945, according to data received from J. R. Schwabrow, Geological Survey, Casper, Wyo. No gas-well completions were reported.

Tennessee.—Information is taken from a report by Kendall E. Born, assistant State geologist, Nashville, Tenn.

The 1945 gas production was about 40 million cubic feet, of which 30 million were produced with oil in the Boone Camp pool near Sunbright, Morgan County (15 wells), and the remainder from the Jamestown field (5 wells) in Fentress County.

A 4-inch line was built in 1945 to take gas from the Sunbright area, a distance of 25 miles to Huntsville in Scott County.

Texas.—Marketed production was 1,525,515 million cubic feet in 1944 and is estimated to have increased to about 1,680,000 in 1945.

Gas-well completions increased remarkably, from 270 in 1944 to 714 in 1945, owing primarily to intensive drilling in the major gas-producing areas in anticipation of expanding gas requirements of the major pipe-line systems, both existing lines and new ones that are planned. Perhaps every important pipe-line system taking gas from Texas fields to distant markets is involved in projected increases in its carrying capacity. In addition, new lines, such as that to California from Texas and New Mexico and those planned to north-central and eastern markets, are expected to build up demand on Texas fields.

In the Panhandle field, 341 gas wells were drilled in 1945, compared with 51 in 1944. In the eastern Texas region the Carthage field had 92 gas-condensate completions, compared with 20 in 1944, adding about 22,000 acres to the field to bring proved acreage to approximately 212,000.

Discoveries in 1945 included 22 condensate fields, of which 17 were in the Gulf coast area, and 35 dry-gas fields, of which 16 were in the Gulf coast. These figures suggest the future importance of the coastal fields as a tremendous source of gas.

A number of important projects were announced during 1945 to increase the recovery of oil through processing of casinghead gas and returning the dry gas to petroleum reservoirs below ground for repressuring or pressure maintenance. In addition to materially increasing the efficiency of oil recovery from natural reservoirs, the benefits will include a substantial production of light liquids from the natural gas and the retention in underground formations of significant quantities of natural gas for future use, both of which would otherwise be dissipated to the atmosphere.

Utah.—A report from J. R. Schwabrow indicates that production of natural gas (all from the Clay Basin field) was 6,671 million cubic feet in 1945, of which 6,652 million were marketed outside the field, 18 million used in field operations, and 1 million cubic feet lost.

A shallow well drilled at South Cisco is reported to have found 1 million cubic feet of gas a day—a discovery of possible commercial value.

At Farnham 140 million cubic feet of carbon-dioxide gas were produced and used in dry-ice manufacture.

Virginia.—No drilling for gas was done in 1945, according to a report from William M. McGill, assistant State geologist, Charlottesville, Va.

Gas production was 56,104,000 cubic feet in 1945, compared with 57,340,000 in 1944, all from the Early Grove field.

The Brooks well, 2 miles west of the Rose Hill oil field, Lee County, was deepened to 4,079 feet through the Trenton limestone without finding new production.

West Virginia.—Of 28 wildcat wells drilled in 1945, 16 resulted in discoveries of gas compared with 25 in 1944, according to a report by David B. Reger, consulting geologist, Morgantown, W. Va.

Proved gas territory added in 1945 in at least six new gas pools and many extensions to existing fields totaled about 58,000 acres. Important additions to gas reserves were made in Wyoming and adjacent southern counties. The development of Oriskany sand gas at Canaan Valley, Dry Fork district, Tucker County, extends significantly to the east the limits of the Appalachian gas province on a long northeast-southwest front. The second well, completed in 1945 on a large structure, produced 5 million cubic feet a day initially from a depth of 8,404 feet, with rock pressure of 3,200 pounds.

Gas-well completions declined from 577 in 1944 to 499 in 1945, distributed by most active counties as follows: Lincoln 78, Kanawah 48, Wayne 45, Boone 39, Upshur 34, and Gilmer 27. Oriskany sand development was less in 1945 than in 1944. Twenty-nine wells were completed, 14 being commercial gas wells. Eleven of the latter extended the old Charleston field to the north and south. Two small producers in Boone County and one in Putnam completed the list.

Marketed production in 1944 was 181,452 million cubic feet and in 1945 is estimated to have declined to 160,000 million cubic feet.

Wyoming.—Thirteen gas wells were completed in 1945 with total open-flow capacity of 80 million cubic feet, according to information received from J. R. Schwabrow, Geological Survey, Casper, Wyo. Only about 37 gas wells have been drilled in Wyoming during the last 5 years. No new gas pipe lines were reported in 1945.

East Muskrat was the only gas field discovered in 1945. New gas zones were found at Big Piney, North Baxter Basin, and South Elk Basin. Gas with condensate was found at 7,242 feet depth in the River dome and a heavy gas flow at Neiber dome demolished the drilling rig after catching fire.

Gross gas production was 51,673 million cubic feet in 1945, compared with 51,602 million in 1944. Repressuring and field use declined slightly to 11,736 and 1,067 million cubic feet, respectively; marketed production and losses increased comparably to 36,357 and

2,512 million cubic feet. Production by leading fields in 1945 was: Baxter Basin, 9,597 million cubic feet; Big Sand Draw, 5,094 million; Garland, 3,685 million; Lance Creek, 2,923 million; and Salt Creek, 2,792 million. Beaver Creek, a 1938 discovery, was produced for the first time in November 1944 and produced a total of 1,017 million cubic feet in 1945.

CONSUMPTION

In 1944 the consumption of natural gas in the United States increased 9 percent over 1943 to a new record of 3,696,463 million cubic feet. As peak-load demand for gas in some important market areas continued to exceed currently available supplies, the consumption was less than would have been normal in the absence of war-imposed restrictions on the use of gas and utility operations.

Major consuming groups increased their use of gas over 1943 as follows: Domestic, 6 percent; commercial, 8 percent; and total industrial, 9 percent. All types of industrial consumers except cement manufacturers used more natural gas in 1944 than in 1943.

The largest consuming States accounted for the following percentages of the United States total in 1944: Texas, 33; California, 14; Louisiana, 8; and Oklahoma, 7. Collectively, they consumed 62 percent in 1944, compared with 66 percent in 1934.

Natural gas consumed in the United States, 1940–44

Year	Domestic and commercial consumption							
	Consumers (thousands) [1]			Billions of cubic feet			Average number of M cubic feet used per domestic and commercial consumer	Average value at points of consumption per M cubic feet (cents)
	Domestic	Commercial	Total	Domestic	Commercial	Total		
1940	9, 245	741	9, 986	444	134	578	57. 9	65. 7
1941	9, 730	767	10, 497	442	145	587	55. 9	65. 9
1942	10, 135	779	10, 914	498	184	682	62. 5	63. 4
1943	10, 354	811	11, 165	529	205	734	65. 8	62. 4
1944	10, 669	845	11, 514	562	221	783	68. 0	61. 4

Year	Industrial consumption							Total consumption		Electric public utility power plants (billions of cubic feet) [3]
	Billions of cubic feet						Average value at points of consumption per M cubic feet (cents)	Billions of cubic feet	Average value at points of consumption per M cubic feet (cents)	
	Field	Carbon-black manufacture	Petroleum refineries	Portland cement plants [2]	Other industrial	Total industrial				
1940	712	369	128	42	826	2, 077	9. 5	2, 655	21. 7	183
1941	686	365	148	54	965	2, 218	10. 5	2, 805	22. 1	205
1942	721	336	202	64	1, 040	2, 363	10. 9	3, 045	22. 7	239
1943	781	315	244	52	1, 277	2, 669	11. 3	3, 403	22. 3	306
1944	855	356	301	35	1, 366	2, 913	10. 8	3, 696	21. 5	360

[1] Includes consumers served with mixed gas.
[2] Chapters on Cement in Minerals Yearbook.
[3] Federal Power Commission: Figures include gas other than natural, impossible to segregate; therefore shown separately from main table.

Natural gas consumed in the United States, 1940–44, by States, in millions of cubic feet

State	1940	1941	1942	1943	1944
Alabama	23,461	32,023	36,287	40,123	44,323
Arizona	18,002	18,213	24,783	24,048	23,908
Arkansas	39,719	46,933	54,069	82,825	94,783
California	351,950	374,905	403,968	457,757	502,017
Colorado	22,111	26,574	28,860	31,424	33,101
District of Columbia	4,686	5,124	5,966	6,754	6,782
Florida	1,481	2,378	3,303	4,033	6,545
Georgia	29,551	23,975	31,996	33,280	35,603
Illinois	88,088	98,634	110,941	122,340	123,325
Indiana	29,214	29,989	37,642	39,227	38,581
Iowa	23,460	24,589	29,481	28,687	27,307
Kansas	96,772	109,059	121,354	129,173	143,814
Kentucky	18,881	20,170	21,382	23,409	24,399
Louisiana	185,089	222,025	253,894	290,651	310,127
Maryland	5,855	6,587	7,438	2,395	2,491
Michigan	32,790	37,290	42,202	53,010	56,077
Minnesota	19,904	22,672	29,116	33,501	35,229
Mississippi	17,657	20,813	26,444	30,113	33,111
Missouri	53,141	58,138	61,354	59,577	65,046
Montana	22,328	24,751	27,773	28,815	29,019
Nebraska	20,087	19,205	20,730	20,462	24,699
New Mexico	40,198	39,138	45,822	52,126	55,284
New York	27,250	25,384	27,150	27,787	27,057
North Dakota	1,725	1,741	1,904	2,030	2,267
Ohio	129,856	136,251	144,325	162,371	166,785
Oklahoma	230,806	209,395	220,991	230,423	249,996
Pennsylvania	121,230	139,492	143,187	159,004	148,675
South Dakota	6,454	6,580	7,611	7,483	7,688
Tennessee	16,819	22,495	22,806	24,252	24,693
Texas	874,294	875,620	917,657	1,059,329	1,221,383
Utah	14,802	16,667	18,920	20,303	20,275
Virginia	963	1,166	1,418	1,610	1,694
Washington	36	1			
West Virginia	77,540	88,597	93,365	94,315	88,953
Wyoming	17,459	18,618	20,634	20,842	21,426
Total United States	2,654,659	2,805,192	3,044,773	3,403,479	3,696,463

Treated for natural gasoline.—Natural-gasoline and cycle plants processed an estimated 3,300,000 million cubic feet of natural gas in 1944, an increase of 9 percent over 1943. In both years the quantity of gas processed equaled 89 percent of total consumption.

In six States in 1944 the quantity of gas treated exceeded total marketed production. This condition often occurs when a large volume of the gas treated is either blown to the air or returned to underground formations after treatment and thus is not a part of marketed production. In a few States—for example, Kansas and West Virginia—a material portion of the gas processed is produced in other States.

Natural gas treated at natural-gasoline and cycle plants in the United States, 1940–44, by States, in millions of cubic feet

State	1940	1941	1942	1943	1944 [1]
Arkansas	26, 584	19, 906	25, 365	43, 309	53, 539
California	375, 407	371, 350	345, 191	349, 383	397, 860
Colorado	142	134	25		
Illinois	12, 716	23, 732	25, 722	32, 200	32, 000
Kansas	150, 963	176, 088	179, 710	196, 043	158, 524
Kentucky	39, 662	38, 062	35, 408	46, 149	48, 746
Louisiana	145, 234	191, 194	247, 370	236, 286	307, 912
Michigan	1, 414	3, 581	1, 418	835	3, 330
Montana	9, 528	10, 386	11, 728	11, 950	11, 630
New Mexico	101, 213	105, 161	108, 911	94, 194	103, 277
New York	40	5	4	4	4
Ohio	38, 547	37, 546	39, 851	39, 106	40, 482
Oklahoma	219, 255	200, 319	202, 653	188, 029	191, 610
Pennsylvania	40, 161	43, 704	46, 603	53, 616	53, 672
Texas	1, 123, 236	1, 325, 471	1, 372, 563	1, 520, 043	1, 682, 738
West Virginia	168, 206	195, 093	197, 643	198, 636	195, 000
Wyoming	19, 092	21, 568	24, 235	18, 217	19, 676
Total	2, 471, 400	2, 763, 300	2, 864, 400	3, 028, 000	3, 300, 000
Ratio to total consumption	93	99	94	89	89

[1] Estimated.

Domestic and commercial.—Consumption of 562,183 million cubic feet of natural gas by domestic users in 1944 exceeded the 1943 record by 6 percent. Since 1938, the domestic consumption has expanded 53 percent as the average annual consumption per domestic meter has increased from 42,900 cubic feet to 52,700 cubic feet, or 23 percent. The average value at points of domestic consumption was 69.1 cents a thousand cubic feet in 1944, compared with 70.0 cents in 1943 and 74.2 cents in 1938.

Commercial consumption increased 8 percent over 1943 to 220,747 million cubic feet. This represents a gain of 93 percent over 1938 as the average yearly consumption per meter increased from 164,600 cubic feet to 261,200 cubic feet, or 59 percent. The average value of this gas at points of consumption was 41.7 cents a thousand cubic feet in 1944, compared with 42.8 cents in 1943 and 49.2 cents in 1938.

Domestic and commercial consumption of natural gas in the United States in 1944, by States [1]

State	Domestic				Commercial				Total			
	Consumers	Quantity (millions of cubic feet)	Value at points of consumption		Consumers	Quantity (millions of cubic feet)	Value at points of consumption		Consumers	Quantity (millions of cubic feet)	Value at points of consumption	
			Total (thousands of dollars)	Average per M cubic feet (cents)			Total (thousands of dollars)	Average per M cubic feet (cents)			Total (thousands of dollars)	Average per M cubic feet (cents)
Alabama	47,190	3,056	2,594	84.9	4,590	1,381	708	51.3	51,780	4,437	3,302	74.4
Arizona	49,340	2,370	2,231	94.1	5,360	2,796	934	33.4	54,700	5,166	3,165	61.3
Arkansas	90,540	8,454	4,065	48.1	14,890	4,639	1,621	34.9	105,430	13,093	5,686	43.4
California	1,921,780	108,993	73,738	67.7	163,500	51,604	20,466	39.7	2,085,280	160,597	94,204	58.7
Colorado	112,630	8,444	6,319	74.8	10,770	2,542	1,406	55.3	123,400	10,986	7,725	70.3
District of Columbia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Florida	6,770	315	333	105.7	630	140	78	55.7	7,400	455	411	90.3
Georgia	101,830	6,882	5,879	85.4	7,180	6,072	1,931	31.8	109,010	12,954	7,810	60.3
Illinois	1,351,280	23,195	26,961	116.2	68,680	6,426	4,830	75.2	1,419,960	29,621	31,791	107.3
Indiana	220,690	5,846	7,335	125.5	12,750	1,745	1,460	83.7	233,440	7,591	8,795	115.9
Iowa	152,870	5,720	5,473	95.7	12,440	2,220	1,284	57.8	165,310	7,940	6,757	85.1
Kansas	248,930	23,185	13,495	58.2	30,030	12,388	3,779	30.5	278,960	35,573	17,274	48.6
Kentucky	192,570	11,092	6,384	57.6	19,340	3,423	1,596	46.6	211,910	14,515	7,980	55.0
Louisiana	239,950	13,831	8,383	60.6	25,850	9,427	2,714	28.8	265,800	23,258	11,097	47.7
Maryland	[2] 238,750	[2] 7,891	[2] 6,171	[2] 78.2	[2] 15,970	[2] 1,823	[2] 1,191	[2] 65.3	[2] 254,720	[2] 9,714	[2] 7,362	[2] 75.8
Michigan	882,920	29,999	30,207	100.7	35,680	5,005	4,163	83.2	918,600	35,004	34,370	98.2
Minnesota	179,370	7,641	5,794	75.8	7,840	2,493	999	40.1	187,210	10,134	6,793	67.0
Mississippi	69,090	5,019	3,535	70.4	9,500	4,213	1,435	34.1	78,590	9,232	4,970	53.8
Missouri	445,770	18,354	15,979	87.1	29,080	3,761	2,180	58.0	474,850	22,115	18,159	82.1
Montana	49,030	7,710	3,620	47.0	4,690	4,509	1,354	30.0	53,720	12,219	4,974	40.7
Nebraska	132,010	6,932	4,859	70.1	9,310	2,444	1,176	48.1	141,320	9,376	6,035	64.4
New Mexico	36,310	3,124	2,144	68.6	4,730	3,368	1,074	31.9	41,040	6,492	3,218	49.6
New York	429,440	17,625	14,405	81.7	36,550	3,904	2,694	69.0	465,990	21,529	17,099	79.4
North Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Ohio	1,321,380	78,141	49,407	63.2	111,560	16,554	9,387	56.7	1,432,940	94,695	58,794	62.1
Oklahoma	293,550	27,274	12,530	45.9	34,590	17,735	4,559	25.7	328,140	45,009	17,089	38.0
Pennsylvania	697,410	43,789	27,098	61.9	46,220	8,833	4,512	51.1	743,630	52,622	31,610	60.1
South Dakota	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Tennessee	59,660	4,690	3,405	72.6	7,980	4,183	1,494	35.7	67,640	8,873	4,899	55.2
Texas	803,710	49,783	31,748	63.8	88,760	26,942	9,610	35.7	892,470	76,725	41,358	53.9
Utah	[3] 60,460	[3] 5,441	[3] 4,003	[3] 73.6	[3] 4,020	[3] 2,759	[3] 1,032	[3] 37.4	[3] 64,480	[3] 8,200	[3] 5,035	[3] 61.4
Virginia	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
West Virginia	207,870	23,368	8,323	35.6	19,620	5,086	1,720	33.8	227,490	28,454	10,043	35.3
Wyoming	25,300	4,019	1,941	48.3	3,110	2,332	750	32.2	28,410	6,351	2,691	42.4
Total: 1944	10,668,400	562,183	388,359	69.1	845,220	220,747	92,137	41.7	11,513,620	782,930	480,496	61.4
1943	10,353,870	529,444	370,558	70.0	811,090	204,793	87,648	42.8	11,164,960	734,237	458,206	62.4

[1] Includes natural gas used with manufactured gas. [2] Maryland includes District of Columbia and Virginia. [3] Utah includes North Dakota and South Dakota.

Field.—Consumption in oil- and gas-field operations increased 10 percent in 1944 to 855,180 million cubic feet and amounted to 23 percent of consumption for all purposes. Four States accounted for 87 percent of the United States total field use in 1944, as follows: Texas, 48; California, 15; Oklahoma, 14; and Louisiana, 10. The same States provided these percentages of United States production of crude petroleum and light liquid products from natural-gas processing plants in 1944: Texas, 45; California, 19; Oklahoma, 8; and Louisiana, 8.

Carbon-black manufacture.—The quantity of gas consumed for this purpose increased 13 percent over 1943 as production of carbon black increased 35 percent. The average value of gas used at the plants increased from 1.47 cents a thousand cubic feet in 1943 to 1.62 cents in 1944, reflecting firmer trends in field values of gas that have continued through 1945 and early 1946.

Petroleum refineries.—A gain of 24 percent to a total of 301,026 million cubic feet in 1944 reflected the continued rapid expansion in use of natural gas as fuel at petroleum refineries that has tripled since 1939. Apparently, the strong demand and firm price tendencies in recent years for fuel oils have made it profitable, particularly in the Southwest and California, to bring gas to refineries for use as a source of processing heat.

Electric public-utility power plants.—The Federal Power Commission reports the use of 359,745 million cubic feet of natural gas (including insignificant amounts of manufactured gas) as fuel at electric power plants in 1944, compared with 305,576 million in 1943. Minor gains were indicated in nearly all consuming States, of which there were 30. Texas, California, and Louisiana used 59 percent of the United States total in 1944.

Portland-cement plants.—Further sharp curtailment in production of portland cement in 1944 reduced consumption of natural gas at these plants to 35,588 million cubic feet, the lowest since 1935. Increases in consumption of principal fuels in 1944 over 1934 were as follows: Coal, 7 percent; natural gas, 30 percent; and fuel oil, 38 percent.

Other industrial.—Miscellaneous industrial utilization of natural gas, including fuel at electric public-utility power plants, increased 7 percent over 1943 to a record of 1,365,969 million cubic feet. More than half of this gain is attributable to the power plants. Declines in general industrial use in the Appalachian region, owing in part to curtailment orders, were offset by larger use in Western States, where transportation factors were not controlling.

Industrial consumption of natural gas in the United States in 1944, by States and uses

State	Field (drilling, pumping, and operating gasoline recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants [1] (millions of cubic feet)
	Millions of cubic feet (estimated)	Value at points of consumption (estimated) (thousands of dollars)	Millions of cubic feet	Value at points of consumption		Millions of cubic feet				Value at points of consumption		Millions of cubic feet	Value at points of consumption		
				Total (thousands of dollars)	Average (cents per M)	Petroleum refineries	Portland cement plants	Other industrial	Total	Total (thousands of dollars)	Average (cents per M)		Total (thousands of dollars)	Average (cents per M)	
Alabama							1,060	38,826	39,886	6,544	16.4	39,886	6,544	16.4	6,609
Arizona								18,742	18,742	3,750	20.0	18,742	3,750	20.0	1,519
Arkansas	17,124	758				6,654	(2)	[2] 57,912	64,566	5,448	8.4	81,690	6,206	7.6	9,571
California	131,848	8,958	(3)	(3)	(3)	52,000	8,926	[3] 148,646	[3] 209,572	[3] 30,322	[3] 14.5	341,420	39,280	11.5	56,682
Colorado	272	19				1	(2)	[2] 21,842	21,843	3,279	15.0	22,115	3,298	14.9	5,207
District of Columbia								(4)	(4)	(4)	(4)	(4)	(4)	(4)	
Florida	6	(5)						6,084	6,084	883	14.5	6,090	883	14.5	2,372
Georgia								22,649	22,649	4,017	17.7	22,649	4,017	17.7	14,165
Illinois	15,546	855				401		77,757	78,158	17,974	23.0	93,704	18,829	20.1	1,951
Indiana	402	36				803		29,785	30,588	8,732	28.5	30,990	8,768	28.3	3,809
Iowa							2,569	16,798	19,367	3,389	17.5	19,367	3,389	17.5	6,406
Kansas	17,756	1,099	(3)	(3)	(3)	6,849	4,101	[3] 79,535	[3] 90,485	[3] 10,126	[3] 11.2	108,241	11,225	10.4	24,705
Kentucky	2,473	388				3		7,408	7,411	2,130	28.7	9,884	2,518	25.5	
Louisiana	82,990	3,160	23,469	607	2.6	49,438	(2)	[2] 130,972	180,410	16,703	9.3	286,869	20,470	7.1	45,833
Maryland								[4] 1,253	[4] 1,253	[4] 673	[4] 53.7	[4] 1,253	[4] 673	[4] 53.7	
Michigan	543	63				52		20,478	20,530	10,004	48.7	21,073	10,067	47.8	17
Minnesota								25,095	25,095	4,506	18.0	25,095	4,506	18.0	8,397
Mississippi	1,893	251						21,986	21,986	3,066	13.9	23,879	3,317	13.9	2,314
Missouri	98	9					637	42,196	42,833	8,383	19.6	42,931	8,392	19.5	10,796
Montana	1,567	76				1,897		13,336	15,233	2,084	13.7	16,800	2,160	12.9	1,159
Nebraska						4	(2)	[2] 15,319	15,323	2,622	17.1	15,323	2,622	17.1	2,959
New Mexico	26,344	470	(3)	(3)	(3)	2,459		[3] 19,989	[3] 22,448	[3] 2,526	[3] 11.3	48,792	2,996	6.1	5,809
New York	125	31				29		5,374	5,403	3,021	55.9	5,528	3,052	55.2	1,295
North Dakota								(6)	(6)	(6)	(6)	(6)	(6)	(6)	256
Ohio	1,299	270				1	1,248	69,542	70,791	27,939	39.5	72,090	28,209	39.1	153

See footnotes at end of table.

Industrial consumption of natural gas in the United States in 1944, by States and uses—Continued

State	Field (drilling, pumping, and operating gasoline recovery plants)		Carbon-black manufacture			Fuel at petroleum refineries, electric public-utility power plants, cement plants, and other industrial						Total industrial			Fuel at electric public-utility power plants [1] (millions of cubic feet)
	Millions of cubic feet (estimated)	Value at points of consumption (estimated) (thousands of dollars)	Millions of cubic feet	Value at points of consumption		Millions of cubic feet				Value at points of consumption		Millions of cubic feet	Value at points of consumption		
				Total (thousands of dollars)	Average (cents per M)	Petroleum refineries	Portland cement plants	Other industrial	Total	Total (thousands of dollars)	Average (cents per M)		Total (thousands of dollars)	Average (cents per M)	
Oklahoma	115,806	4,345	6,416	227	3.5	21,009	(2)	[2] 61,756	82,765	8,183	9.9	204,987	12,755	6.2	26,164
Pennsylvania	6,487	1,818				678		88,888	89,566	29,011	32.4	96,053	30,829	32.1	9
South Dakota							(2)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	1,929
Tennessee								15,820	15,820	2,338	14.8	15,820	2,338	14.8	6,175
Texas	413,268	11,718	309,369	4,259	1.4	152,969	8,428	260,624	422,021	38,641	9.2	1,144,658	54,618	4.8	111,390
Utah						120	(2)	[2, 6] 21,910	[6] 22,030	[6] 3,344	[6] 15.2	[6] 22,030	[6] 3,344	[6] 15.2	35
Virginia								(4)	(4)	(4)	(4)	(4)	(4)	(4)	
West Virginia	11,693	2,239				948		47,858	48,806	11,323	23.2	60,499	13,562	22.4	1,679
Wyoming	7,640	305				4,711		2,724	7,435	853	11.5	15,075	1,158	7.7	380
Miscellaneous			[3] 16,516	[3] 670	[3] 4.1		[2] 8,619								
Total: 1944	855,180	36,868	355,770	5,763	1.6	301,026	35,588	1,365,969	1,702,583	271,144	15.9	2,913,533	313,775	10.8	359,745
1943	780,986	33,288	315,562	4,624	1.5	243,584	51,748	1,277,362	1,572,694	262,819	16.7	2,669,242	300,731	11.3	305,576

[1] Federal Power Commission: Figures include gas other than natural, impossible to segregate; therefore shown separately from main table.

[2] Gas used in portland-cement plants included under "Miscellaneous" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[3] Gas used in carbon-black manufacture included under "Miscellaneous" for United States total and under "Other industrial" for State total to avoid disclosing figures of individual operators.

[4] Maryland includes District of Columbia and Virginia.

[5] Less than $500.

[6] Utah includes North Dakota and South Dakota.

Mixed gas.—In the adjacent table showing consumption of natural gas used with manufactured gas, the quantity figures refer only to the natural-gas component of mixed gas. They do not measure the total volume of gas sold in the form of mixed gas.

Fewer mixed-gas consumers in the District of Columbia, Pennsylvania, and Maryland caused the total number of reported consumers to decline, but natural gas used in mixtures increased from 84,853 million cubic feet in 1943 to 89,645 million in 1944.

Consumption of natural gas used with manufactured gas in the United States in 1944, by States

State	Domestic		Commercial		Industrial (millions of cubic feet)	Total	
	Consumers	Millions of cubic feet	Consumers	Millions of cubic feet		Millions of cubic feet	Value at points of consumption (thousands of dollars)
District of Columbia	153,180	4,966	11,230	1,191	553	6,710	4,679
Illinois	1,095,020	17,535	51,130	4,925	8,912	31,372	25,992
Indiana	49,740	1,184	2,110	291	1,370	2,845	2,578
Iowa	62,490	1,334	4,530	578	216	2,128	1,765
Kentucky	84,940	3,502	7,500	1,606	1,595	6,703	3,520
Maryland	23,870	1,149	730	70	76	1,295	1,088
Michigan	6,490	55	320	10	12	77	95
Minnesota	147,750	5,185	4,930	438	531	6,154	4,705
Missouri	263,490	5,451	11,280	935	769	7,155	7,058
Nebraska	58,910	1,509	370	74	181	1,764	1,044
New York	288,330	9,089	16,050	1,453	1,313	11,855	9,005
Ohio	170,920	4,389	16,280	1,721	1,756	7,866	4,619
Pennsylvania	42,430	2,070	2,720	366	488	2,924	1,815
Tennessee	1,150	12	90	8	1	21	26
Virginia	30,250	579	1,930	161	36	776	736
Total: 1944	2,478,960	58,009	131,200	13,827	17,809	89,645	68,725
1943	2,489,100	55,750	133,130	12,603	16,500	84,853	67,090

Balance of natural-gas supply and demand for selected States, 1935, 1943, and 1944, in millions of cubic feet

Year and State	Marketed production	Receipts from other States	Total supply and demand	Consumption within State	Deliveries to other States	Ratio of deliveries to total supply (percent)
1935						
Kansas	57,125	45,019	102,144	72,806	29,338	28.7
Kentucky	39,738	5,985	45,723	15,826	29,897	65.4
Louisiana	249,450	4,282	253,732	151,934	101,798	40.1
Oklahoma	274,313	9,565	283,878	258,598	25,280	8.9
Texas	642,366	33,054	675,420	525,697	[1] 149,723	22.2
West Virginia	115,772	7,797	123,569	53,763	69,806	56.5
1943						
Kansas	133,729	71,663	205,392	129,173	76,219	37.1
Kentucky	92,364	4,182	96,546	23,409	73,137	75.8
Louisiana	505,294	9,576	514,870	290,651	224,219	43.5
Oklahoma	285,045	14,974	300,019	230,423	69,596	23.2
Texas	1,323,885	41,100	1,364,985	1,059,329	[1] 305,656	22.4
West Virginia	223,787	24,013	247,800	94,315	153,485	61.9
1944						
Kansas	157,733	78,846	236,579	143,814	92,765	39.2
Kentucky	94,223	3,848	98,071	24,399	73,672	75.1
Louisiana	534,688	9,520	544,208	310,127	234,081	43.0
Oklahoma	310,888	17,717	328,605	249,996	78,609	23.9
Texas	1,525,515	39,029	1,564,544	1,221,383	[1] 343,161	21.9
West Virginia	181,452	31,591	213,043	88,953	124,090	58.2

[1] Includes exports to Mexico.

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INTERSTATE SHIPMENTS AND EXPORTS

The upward trend in interstate shipments (including exports) continued in 1944 as the total movement expanded 4 percent to 1,029,758 million cubic feet.

Among States that market more gas than they consume, the largest gains in outward shipments were from Texas (38 billion cubic feet), Kansas (17 billion), Louisiana (10 billion), and Oklahoma (9 billion). A large decline in West Virginia shipments (29 billion cubic feet) accompanied declining output of the great Oriskany-sand field near Charleston, W. Va.

Interstate transportation of natural gas in 1944 [1]

State from which gas was transported	State through which gas was transported	State to which gas was transported	Millions of cubic feet
Arkansas		Louisiana	383
Colorado	Wyoming	Utah	4,625
		Wyoming	7
			4,632
Illinois		Indiana	55
Indiana		Illinois	4
		Kentucky	80
			84
Kansas		Colorado	888
	Missouri	Illinois	4,466
	do Illinois	Indiana	7,992
	Nebraska	Iowa	10,343
	do South Dakota	do	40
	Missouri Illinois Indiana	Kentucky	369
	Missouri Illinois Indiana Ohio	Michigan	13,162
	Nebraska Iowa	Minnesota	18,566
		Missouri	9,760
		Nebraska	14,003
	Nebraska Iowa	do	3
	Missouri Illinois Indiana	Ohio	10,412
		Oklahoma	802
	Nebraska	South Dakota	1,959
			92,765
Kentucky	West Virginia Virginia Maryland	District of Columbia	6,782
		Indiana	177
	West Virginia Virginia	Maryland	700
	West Virginia Virginia Maryland District of Columbia	do	1,319
		Ohio	6,807
	West Virginia	do	8,865
	do	Pennsylvania	21,354
	do Virginia Maryland	do	1,141
	West Virginia	Virginia	250
	do Virginia Maryland District of Columbia	do	752
		West Virginia	25,525
			73,672

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1944 [1]—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	Millions of cubic feet
Louisiana	Mississippi	Alabama	40,330
		Arkansas	40,191
	Mississippi		
	Alabama	Florida	6,535
	Mississippi		
	Alabama	Georgia	30,470
	Arkansas		
	Missouri	Illinois	20,443
		Mississippi	26,934
	Arkansas	do	3,680
	do	Missouri	20,970
	Arkansas		
	Mississippi	Tennessee	24,555
		Texas	19,973
			234,081
Mississippi		Alabama	50
	Alabama	Florida	4
			54
Montana		North Dakota	2,266
	North Dakota	South Dakota	3,767
			6,033
New Mexico	Texas		
	New Mexico	Arizona	23,908
		Colorado	295
	Texas		
	New Mexico		
	Arizona	Mexico	1,474
		Texas	8,768
			34,445
New York		Canada	31
		Pennsylvania	604
			635
North Dakota	Montana		
	North Dakota	South Dakota	199
Ohio		West Virginia	797
Oklahoma		Arkansas	3,965
	Kansas		
	Missouri	Illinois	171
	Kansas		
	Missouri		
	Illinois	Indiana	304
		Kansas	44,988
	Kansas		
	Missouri		
	Illinois		
	Indiana	Kentucky	14
	Kansas		
	Missouri		
	Illinois		
	Indiana		
	Ohio	Michigan	509
	Kansas	Missouri	17,392
	do	Nebraska	583
	Kansas		
	Missouri		
	Illinois		
	Indiana	Ohio	395
		Texas	10,288
			78,609
Pennsylvania	New York	Canada	112
		Maryland	104
		New York	20,640
		Ohio	103
		West Virginia	1,053
			22,012

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1944 [1]—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	Millions of cubic feet
Texas	Louisiana Mississippi	Alabama	3,943
	Louisiana	Arkansas	4,557
	New Mexico	Colorado	31,409
	Louisiana Mississippi Alabama	Georgia	5,133
	Oklahoma Kansas Missouri	Illinois	7,629
	Oklahoma Kansas Nebraska Iowa	do	72,530
	Oklahoma Kansas Missouri Illinois	Indiana	13,670
	Oklahoma Kansas Nebraska Iowa Illinois	do	15,453
	Oklahoma Kansas Nebraska	Iowa	16,889
	Oklahoma Kansas Nebraska South Dakota	do	35
	Oklahoma	Kansas	33,858
	Arkansas Louisiana Mississippi Tennessee	Kentucky	415
	Oklahoma Kansas Missouri Illinois Indiana	do	635
		Louisiana	9,137
		Mexico	12,959
	Oklahoma Kansas Missouri Illinois Indiana Ohio	Michigan	22,687
	Oklahoma Kansas Nebraska Iowa Illinois Indiana	do	66
	Oklahoma Kansas Nebraska Iowa	Minnesota	16,663
	Louisiana	Mississippi	1,199
	Oklahoma Kansas	Missouri	16,765
	Oklahoma Kansas	Nebraska	8,454
	Oklahoma Kansas Nebraska Iowa	do	3
		New Mexico	2,002
	Louisiana Arkansas Mississippi Tennessee Kentucky West Virginia	Ohio	3,622
	Oklahoma Kansas Missouri Illinois Indiana	do	17,794
		Oklahoma	16,915

[1] Includes exports to Canada and Mexico.

Interstate transportation of natural gas in 1944 [1]—Continued

State from which gas was transported	State through which gas was transported	State to which gas was transported	Millions of cubic feet
Texas—Continued.	Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, West Virginia	Pennsylvania	1,730
	Oklahoma, Kansas, Nebraska	South Dakota	1,758
	Louisiana, Arkansas, Mississippi	Tennessee	107
	Louisiana, Arkansas, Mississippi, Tennessee, Kentucky	West Virginia	4,216
	New Mexico, Colorado	Wyoming	928
			343,161
Virginia		Tennessee	21
West Virginia		Kentucky	2,335
		Maryland	1,068
		Ohio	66,036
	Kentucky	do	1,824
		Pennsylvania	50,435
	Maryland	do	572
	Virginia, Maryland	do	1,164
		Virginia	656
			124,090
Wyoming		Montana	2,950
		Nebraska	1,653
		Utah	9,427
			14,030
			1,029,758

[1] Includes exports to Canada and Mexico.

PIPE-LINE DEVELOPMENTS

Much of the new construction of gas-transmission facilities in 1945 was directed toward the provision of larger capacity for major pipe-line systems. Among the transmission companies that made substantial investments in added compressor horsepower, loop or connecting lines, or field gathering systems were: Memphis Natural Gas Co., Northern Natural Gas Co., Cities Service Gas Co., Panhandle Eastern Pipe Line Co., Interstate Natural Gas Co., United Gas Pipe Line Co., Kansas-Nebraska Natural Gas Co., Natural Gas Pipe Line Co. of America.

In addition to the project to bring gas from western Texas and New Mexico to southern California, on which contracts have already been signed, several proposals have been made to lay new pipe lines to carry gas to Michigan, Wisconsin, Ohio, and adjacent markets from Texas fields. These interstate projects are of course subject to approval of the Federal Power Commission, and some may be affected by the disposition to be made of the two war-emergency pipe lines—Big Inch and Little Inch—running from Texas to the New York-Philadelphia area. No decision has yet been made with respect to the permanent disposal of these large lines, although bids from private interests have been received for both oil and natural-gas transportation.

NATURAL GASOLINE

AND LIQUEFIED PETROLEUM GASES[1]

By F. S. Lott[2] and A. T. Coumbe

SUMMARY OUTLINE

NATURAL GASOLINE

SUMMARY

Total production of the natural-gasoline industry in 1945 reached a new record of 4,673,507 thousand gallons, a gain of 11 percent over 1944. The estimated value at plants of all liquid products was $196,000,000, compared with $182,500,000 in 1944. Until the end of hostilities in August 1945, the demand for all products was strong. In succeeding months demand and production were temporarily reduced as a result of curtailment of operations at petroleum refineries, incident to decreased war demands and shut-downs due to strikes in September and October.

Prices were generally firm until the latter months of 1945, when lower tendencies appeared. The Mid-Continent (Group 3) spot price for 26–70 grade natural gasoline averaged 4.75 cents per gallon in 1944 and 4.56 cents in 1945.

Total stocks of light products changed only from 186,942 thousand gallons on January 1, 1945, to 181,513 thousand gallons on December 31. Refinery stocks declined about 30 million gallons, and those at plants and terminals increased 24 million gallons. Nearly all of this increase was at installations east of California.

[1] Data for 1945 are preliminary; detailed statistics with final revisions will be released later.
[2] Tables compiled by E. M. Seeley, Petroleum Economics Division, Bureau of Mines.

Salient statistics of the natural-gasoline industry in the United States, 1941–45, in thousands of gallons

	1941	1942	1943	1944	1945
Production:					
Natural gasoline and natural-gasoline mixtures	2,208,360	2,071,104	2,115,372	2,188,284	2,566,152
Liquefied petroleum gases:					
Isobutane	127,932	101,682	150,738	209,412	163,689
Other L. P. G	579,264	671,874	760,116	961,212	1,258,646
Other products	480,354	654,864	657,846	843,024	685,020
Total	3,395,910	3,499,524	3,684,072	4,201,932	4,673,507
Receipts from outside sources	87,676	62,991	55,600	112,182	120,074
Stock change at plants and terminals	−39,774	+29,316	−27,216	+798	+24,139
Total supply	3,523,360	3,533,199	3,766,888	4,313,316	4,769,442
Shipments to refineries:					
Natural gasoline and natural-gasoline mixtures	2,292,318	1,755,357	1,938,136	2,060,985	2,456,009
Liquefied petroleum gases	[1] 435,540	428,501	463,955	534,274	718,922
Other products	([2])	501,725	466,143	629,949	424,181
To jobbers and trade outlets:					
Natural gasoline					102,640
Condensate	402,318	274,794	162,890	118,608	6,511
Finished gasoline and naphtha		141,006	129,262	134,610	205,737
Sales of liquefied petroleum gases:					
For fuel	[1] 263,802	302,190	486,738	608,881	616,260
For chemical manufacture	([3])	([3])	([3])	96,558	155,889
Transfers of cycle products	([4])	([4])	66,108	76,482	35,658
Exports from plants	50,791	43,778	23,612	28,351	22,465
Losses	78,591	85,848	30,044	24,618	25,170
Total demand at plants and terminals	3,523,360	3,533,199	3,766,888	4,313,316	4,769,442
Stocks at plants, terminals, and refineries:					
Natural gasoline	171,276	157,374	130,410	114,702	101,726
Liquefied petroleum gases	6,804	23,646	45,024	46,452	39,517
Other products	8,274	13,524	15,288	17,430 [5] 25,788	40,270
Total	186,354	194,544	190,722	178,584 [5] 186,942	181,513
Value at plants:					
Natural gasoline ..... thousands of dollars	88,877	78,170	95,273	[1] 110,800	[1] 121,680
Liquefied petroleum gases ..... do	13,305	19,000	24,410	[1] 34,300	[1] 43,500
Other products ..... do	16,938	24,395	27,227	[1] 37,400	[1] 30,820
Average per gallon ..... cents	3.5	3.5	4.0	4.3	4.2
Natural gas treated ..... millions of cubic feet	2,763,300	2,864,400	3,028,000	[1] 3,300,000	[1] 3,553,000
Average yield, light products except L. P. G. per M cubic feet ..... gallons	0.97	0.95	0.92	0.92	0.92
Average yield, all light products ..... do	1.23	1.22	1.22	1.27	1.32
Sales to consumers for fuel and chemical uses: [6]					
L. P. G	263,814	362,168	495,557	703,786	839,084
L. R. G	199,038	223,272	179,676	356,370	437,682
Total	462,852	585,440	675,233	[7] 1,060,156	1,276,766
Total exports of natural gasoline and liquefied petroleum gases [8]	53,886	57,414	35,154	42,702	62,833

[1] Estimated.
[2] Included in natural gasoline.
[3] Included in shipments to refineries.
[4] Not available.
[5] For comparison with 1945.
[6] From independent survey of consumption. See discussion on Liquefied Petroleum Gases at end of this chapter.
[7] Revised.
[8] Figures from data compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

A total of 62,833,000 gallons of light products was exported in 1945, an increase of 47 percent over 1944. Fourth quarter shipments more than doubled those in the comparable 1944 period.

The table of salient statistics in this chapter has been arranged to reflect the balance of supply and demand at natural-gasoline and cycle plants. It, therefore, omits the item "Benzol" shown in preceding chapters of this series and uses shipments to refineries as reported by the plant operators instead of quantities of light products utilized at refineries as reported by petroleum refineries. The form is similar to the table on page 2 of the Monthly Natural Gasoline Report, as first published in the issue of January 1945. The item "Receipts from outside sources" represents light end products of crude petroleum origin, shipped from petroleum refineries to plants for processing or blending with natural-gas liquids. "Exports from plants" covers reported shipments for export from plants and terminals. They differ from "Total exports," shown at the bottom of the table, by the quantity of similar products exported from refineries. The item "Losses" represents only reported losses at plants.

PRICES AND MARKET CONDITIONS

After selling at the ceiling price of 4.75 cents a gallon since October 8, 1943, the 26–70 grade of natural gasoline in Oklahoma dropped ¼ cent to 4.50 cents on April 3, 1945, and held at that level to the end of the year, except for a few sales at 4.25 cents early in December. This grade of natural gasoline f. o. b. Breckenridge, Tex., however, reflected softening markets after March 31 and declined by successive stages from 4.375 cents a gallons to 3.5 cents on December 31, 1945. These declines forecast the weak markets experienced in early 1946, when the Oklahoma and Breckenridge prices fell to 2.75 and 2.25 cents, respectively, as the end of the high seasonal demand from refineries approached.

Although price ceilings on light products were unchanged in 1945, they became ineffectual later in the year because products generally

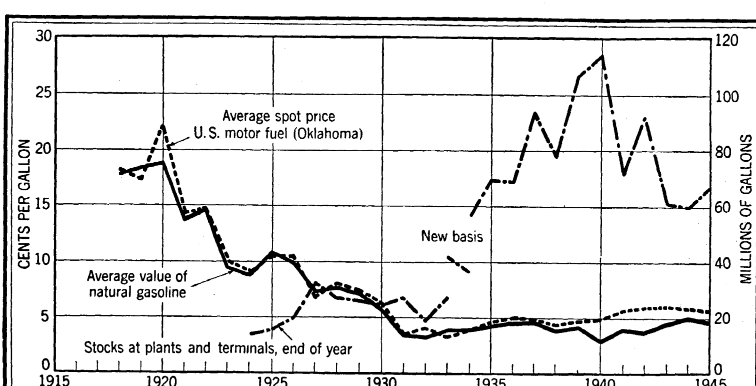

FIGURE 1.—Trends in average value of natural gasoline, spot price of gasoline, and stocks of natural gasoline, 1918–45.

sold below them. Quotations on sales of liquefied petroleum gases are not available, but average prices undoubtedly declined as a result of the curtailment of aviation-gasoline production after August 1.

The octane rating of U. S. motor fuel was changed on September 1, 1945, from 70–74 to 73–75. The average spot price for this grade at Oklahoma refineries declined from 5.95 cents a gallon in 1944 to 5.89 cents in 1945, owing in part to price shading in November and December 1945.

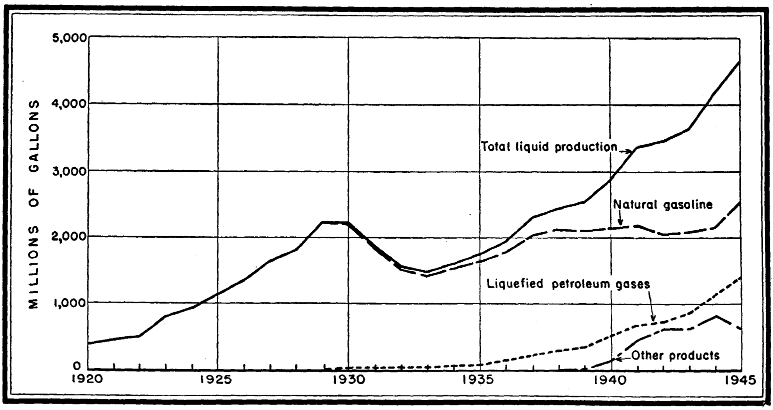

FIGURE 2.—Annual production of the natural-gasoline industry, 1920–45.

PRODUCTION

Trends in total output.—Total liquid production of the industry averaged 13,011,000 gallons daily in January 1945, rose to a peak of 13,151,000 gallons in May, and, after an autumn decline, returned to 13,048,000 gallons in December. Although the output of liquefied petroleum gases in December remained 9 percent below the January rate, natural-gasoline output increased 10 percent.

Figure 2 shows graphically the trends of production at natural-gasoline and cycle plants since 1920. The output of liquefied petroleum gases prior to 1941 has been estimated, chiefly on the basis of early surveys of sales for fuel. Total production of light products in 1945 was 38 percent above 1941. Liquefied petroleum gases—the component having the largest growth factor—gained 101 percent in the same period. For comparison, the increase in production of domestic crude petroleum in 1945 over 1941 was 22 percent.

California.—Total output of light products at plants was 889.5 million gallons in 1945, an increase of 15 percent over 1944. After August, production was reduced about 8 percent below the rate of earlier months. Gains of 3 percent in natural gasoline and 19 percent in liquefied-petroleum-gas output were supplemented by inclusion of the production of other products (70.8 million gallons), chiefly condensate, for the first time. In 1944 this material was reported as a part of crude petroleum production.

Natural gasoline and allied products produced and natural gas treated in the United States, 1944–45, by States

State	Number of operators [2]	Natural gasoline		Liquefied petroleum gases		Other products [1]		Natural gas treated		
		Thousands of gallons	Thousands of dollars [3]	Thousands of gallons	Thousands of dollars [3]	Thousands of gallons	Thousands of dollars [3]	Millions of cubic feet [4]	Average yield (gallons per M cubic feet): Light products except L. P. G.	Average yield (gallons per M cubic feet): All light products
1944										
Arkansas	9	43, 701	2, 190	31, 835	800	---	---	53, 539	0. 82	1. 41
California	29	632, 768	28, 530	138, 512	4, 445	---	---	397, 860	1. 59	1. 94
Colorado	---	(5)	(5)	---	---	---	---	---	---	---
Illinois	15	61, 351	3, 870	133, 018	4, 130	---	---	32, 000	1. 92	6. 07
Kansas	9	54, 045	2, 600	15, 789	525	---	---	158, 524	. 34	. 44
Kentucky	4	10, 997	650	37, 745	900	---	---	48, 746	. 23	1. 00
Louisiana	19	118, 170	5, 800	82, 835	2, 665	291, 654	12, 835	307, 912	1. 33	1. 60
Michigan	2	4, 055	210	4, 445	147	---	---	3, 330	1. 22	2. 55
Montana	1	2, 886	200	1, 882	110	---	---	11, 630	. 25	. 41
New Mexico	6	69, 528	3, 345	11, 633	326	---	---	103, 277	. 67	. 79
New York	1	12	1	---	---	---	---	4	3. 00	3. 00
Ohio	5	7, 282	440	---	---	---	---	40, 482	. 18	. 18
Oklahoma	40	301, 246	17, 200	120, 522	3, 400	---	---	191, 610	1. 57	2. 20
Pennsylvania	40	17, 023	990	472	42	---	---	53, 672	. 32	. 33
Texas	88	773, 507	38, 734	544, 618	14, 765	551, 370	25, 365	1, 682, 738	. 79	1. 11
Utah	---	(5)	(5)	---	---	---	---	---	---	---
West Virginia	17	57, 298	3, 210	31, 619	1, 335	---	---	195, 000	. 29	. 46
Wyoming	5	[5] 34, 415	[5] 2, 030	15, 699	710	---	---	19, 676	1. 75	2. 55
	236	2, 188, 284	110, 000	1,170,624	34, 300	843, 024	38, 200	3, 300, 000	. 92	1. 27
1945 [6]										
Arkansas	9	49, 932	2, 370	33, 075	890	1, 394	70	54, 835	. 94	1. 54
California	30	653, 276	28, 875	165, 405	5, 540	70, 792	2, 900	414, 932	1. 75	2. 14
Colorado	---	(7)	(7)	---	---	---	---	---	---	---
Illinois	15	55, 233	3, 330	120, 683	3, 980	---	---	30, 319	1. 82	5. 80
Kansas	9	59, 019	2, 680	14, 279	500	2	(8)	168, 972	. 35	. 43
Kentucky	4	9, 248	510	38, 061	850	128	7	49, 216	. 19	. 96
Louisiana	19	222, 494	10, 320	121, 961	4, 150	204, 447	9, 200	299, 127	1. 43	1. 84
Michigan	2	5, 369	260	8, 092	480	---	---	4, 183	1. 28	3. 22
Montana	1	2, 969	195	1, 930	100	---	---	10, 803	. 27	. 45
New Mexico	8	87, 097	3, 940	10, 701	320	1	(8)	116, 898	. 75	. 84
New York	1	5	(8)	---	---	---	---	2	2. 50	2. 50
Ohio	4	5, 777	335	---	---	719	43	34, 190	. 19	. 19
Oklahoma	40	272, 028	14, 750	136, 224	4, 100	8, 597	450	198, 577	1. 41	2. 10
Pennsylvania	36	13, 717	770	573	50	1	(8)	48, 062	. 29	. 30
Texas	89	1, 044, 836	48, 690	719, 931	20, 740	394, 233	17, 900	1, 878, 546	. 77	1. 15
Utah	---	(9)	(9)	---	---	---	---	---	---	---
West Virginia	17	51, 839	2, 770	34, 116	1, 000	4, 706	250	222, 486	. 25	. 41
Wyoming	5	[7] 33, 313	[7] 1, 885	17, 304	800	---	---	21, 852	1. 52	2. 32
	233	2, 566, 152	121, 680	1,422,335	43, 500	685, 020	30, 820	3, 553, 000	. 92	1. 32

[1] Other products include finished gasoline, condensate, kerosine, distillate fuel, "Special" naphtha, toluene, etc.
[2] A producer operating in more than 1 State is counted but once in arriving at total for United States.
[3] Estimated.
[4] Partly estimated.
[5] Drip gasoline produced in Colorado and Utah combined with Wyoming.
[6] Subject to revision.
[7] Drip gasoline produced in Colorado combined with Wyoming.
[8] Less than $500.
[9] Not available.

Kettleman Hills plants produced 170 million gallons of light products in 1945 compared with 171 million in 1944, and Ventura Avenue increased from 86 to 90 million gallons. The largest gain in 1945 was in the Paloma field, where cycling operations were begun in June 1944.

Louisiana.—An increase of 11 percent in production over 1944 to 548.9 million gallons resulted from a gain of 30 percent in the Gulf and a loss of 7 percent in the Inland district. Indicated gains of 88 percent in natural gasoline and 47 percent in liquefied-petroleum-gas production accompanied a decline of 30 percent in other products in 1945. The figures for natural gasoline and the "Other products" group in 1945 are not directly comparable with 1944 because a reclassification of output in 1945 increased the proportion of natural gasoline and reduced that of other products, relative to earlier years.

Oklahoma.—Production in 1945 totaled 416.8 million gallons compared with 421.8 million in 1944, hence the slow decline that began in 1942 continued. A 10 percent reduction in natural-gasoline output in 1945 to 272,028 thousand gallons was offset in part by an increase of 13 percent in liquefied petroleum gases to 136,224 thousand gallons. The Oklahoma City field produced 65 million gallons of light products in 1945, compared with 53 million gallons in 1944; Osage County declined to 73 from 75 million gallons in 1944.

Monthly production of natural gasoline and allied products in the United States, 1944–45, by States and districts, in millions of gallons

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1944													
West New York and West Pennsylvania	1.9	1.7	1.8	1.7	1.3	1.0	0.9	1.0	1.2	1.6	1.6	1.8	17.5
West Virginia	9.0	8.2	8.7	7.8	7.0	6.1	5.8	5.6	6.4	7.9	7.8	8.6	88.9
Ohio	.9	.8	.8	.7	.4	.4	.4	.4	.5	.6	.6	.8	7.3
Illinois	17.6	16.7	18.0	15.7	16.0	15.0	15.2	15.8	15.2	16.7	16.5	16.0	194.4
Kentucky	4.0	3.8	4.1	3.8	3.5	3.2	3.8	4.1	4.3	4.9	4.9	4.3	48.7
Michigan	.1	.2	.2	.2	.8	.9	1.0	1.0	.9	1.1	1.0	1.1	8.5
Kansas	6.6	5.9	6.0	6.1	5.8	5.5	5.2	5.3	5.5	6.0	6.1	5.8	69.8
Oklahoma	34.4	33.7	35.4	34.8	34.9	33.9	34.9	35.2	35.1	36.9	36.3	36.3	421.8
Texas:													
Gulf	38.4	34.7	36.8	36.2	38.0	36.8	38.5	38.8	36.7	42.2	41.3	44.1	462.5
East Texas	25.7	26.5	26.8	25.9	27.1	27.4	29.4	30.4	28.7	29.3	27.2	27.2	331.6
Panhandle	38.4	39.1	41.7	39.6	37.2	36.2	38.4	35.7	37.4	37.2	43.8	39.8	464.5
Rest of State	47.7	44.4	48.4	47.8	50.9	50.0	53.3	53.6	51.8	54.5	52.2	56.3	610.9
Total Texas	150.2	144.7	153.7	149.5	153.2	150.4	159.6	158.5	154.6	163.2	164.5	167.4	1,869.5
Arkansas	5.2	5.8	6.2	6.1	6.2	6.2	6.4	6.5	6.4	6.3	6.8	7.4	75.5
Louisiana:													
Gulf	6.1	6.9	6.9	8.7	21.3	26.4	28.8	28.7	27.8	27.8	27.2	27.4	244.0
Inland	22.7	20.5	21.6	21.2	20.9	20.3	19.7	19.5	19.3	20.9	20.6	21.4	248.6
Total Louisiana	28.8	27.4	28.5	29.9	42.2	46.7	48.5	48.2	47.1	48.7	47.8	48.8	492.6
New Mexico	5.8	6.7	6.6	6.7	7.1	6.7	7.2	7.6	7.2	7.1	6.5	6.0	81.2
Montana	.5	.5	.4	.5	.3	.3	.3	.3	.3	.3	.5	.6	4.8
Colorado, Utah, and Wyoming	2.6	3.3	4.1	3.8	4.2	4.2	4.2	4.6	4.7	4.9	4.8	4.7	50.1
California	60.9	58.3	63.6	61.5	64.7	63.3	66.4	66.8	65.4	67.2	64.9	68.3	771.3
Total United States	328.5	317.7	338.1	328.8	347.6	343.8	359.8	360.9	354.8	373.4	370.6	377.9	4,201.9
Daily average	10.6	11.0	10.9	11.0	11.2	11.5	11.6	11.6	11.8	12.0	12.4	12.2	11.5

Monthly production of natural gasoline and allied products in the United States, 1944–45, by States and districts, in millions of gallons—Continued

Field	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1945 [1]													
West New York and West Pennsylvania	1.7	1.5	1.5	1.4	1.2	1.0	0.8	0.8	0.8	1.1	1.2	1.3	14.3
West Virginia	8.8	7.9	7.9	7.3	7.4	6.1	5.7	5.5	5.1	8.8	9.6	10.6	90.7
Ohio	.8	.7	.6	.5	.5	.4	.3	.4	.5	.6	.6	.6	6.5
Illinois	15.8	14.1	15.4	15.1	15.3	15.0	15.2	15.1	12.7	13.6	14.5	14.1	175.9
Kentucky	3.2	3.6	4.5	4.4	4.5	4.0	3.6	3.7	1.3	4.8	4.7	5.1	47.4
Michigan	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.1	13.5
Kansas	6.1	5.9	5.7	5.6	6.0	6.1	6.0	5.9	6.1	6.0	7.1	6.8	73.3
Oklahoma	37.0	32.9	35.1	33.7	35.9	34.0	34.2	35.0	34.2	33.9	35.0	35.9	416.8
Texas:													
Gulf	47.0	42.9	45.0	43.0	44.8	43.8	46.1	44.9	41.5	43.6	43.5	45.7	531.8
East Texas	30.2	28.6	31.3	30.1	33.8	32.8	33.9	34.4	29.7	27.7	26.6	25.5	364.6
Panhandle	48.7	44.6	45.8	46.6	46.4	41.6	41.2	41.7	44.0	45.5	47.5	49.5	543.1
Rest of State	57.8	53.0	59.9	59.4	62.5	59.3	62.9	62.4	54.4	61.1	60.6	66.2	719.5
Total Texas	183.7	169.1	182.0	179.1	187.5	177.5	184.1	183.4	169.6	177.9	178.2	186.9	2,159.0
Arkansas	7.4	7.0	7.6	7.2	7.4	7.3	7.3	7.0	6.2	6.2	6.3	7.5	84.4
Louisiana:													
Gulf	29.9	26.2	28.4	24.5	27.1	26.9	27.5	27.8	20.7	24.3	27.1	27.5	317.9
Inland	20.7	18.9	21.4	20.7	21.4	21.2	21.5	18.0	6.6	18.2	19.8	22.6	231.0
Total Louisiana	50.6	45.1	49.8	45.2	48.5	48.1	49.0	45.8	27.3	42.5	46.9	50.1	548.9
New Mexico	6.3	6.0	8.5	8.5	8.9	9.2	9.2	9.3	8.7	8.1	7.9	7.2	97.8
Montana	.4	.5	.5	.5	.4	.3	.3	.3	.3	.4	.5	.5	4.9
Colorado and Wyoming	4.5	4.5	4.8	4.3	5.2	4.6	4.7	4.2	3.6	3.6	3.3	3.3	50.6
California	76.1	67.8	75.0	75.0	77.8	75.0	78.1	77.6	72.2	70.5	70.9	73.5	889.5
Total United States	403.4	367.6	400.0	388.9	407.7	389.8	399.7	395.2	349.8	379.1	387.8	404.5	4,673.5
Daily average	13.0	13.1	12.9	13.0	13.2	13.0	12.9	12.7	11.7	12.2	12.9	13.0	12.8

[1] Subject to revision.

Texas.—The output of light products continued in 1945 its upward trend, gaining 15 percent over 1944 to 2,159.0 million gallons. Increases of 35 percent in natural gasoline and 32 percent in liquefied petroleum gases were accompanied by an apparent decline of 28 percent in other products output. As in Louisiana, the first and third items above were affected in 1945 by a reclassification of plant output. Several new plants commenced operations in 1945, of which the largest was at Sheridan, Colorado County.

Other States.—Production of New Mexico and Arkansas increased 20 and 12 percent, respectively, in 1945 to new records. The volume of light products produced in Michigan continued to increase and approached in 1945 that of New York-Pennsylvania, which declined. Illinois production decreased 10 percent from its 1944 peak. All producing States, except the four leading ones, accounted for 14 percent of total United States output of light products in 1945, compared with 15 percent in 1941.

TRANSITION

In the months following the end of hostilities in August, production of light products declined 11 percent and then followed an upward trend to new record levels early in 1946. The demand for natural gasoline at refineries remained high through the winter months, influenced by the seasonal need for "volatility" in gasoline.

Total shipments to refineries of liquefied petroleum gases dropped abruptly from about 70 million gallons monthly to 42 million in September and were below a 35-million-gallon monthly rate in early 1946, a decline of more than 50 percent from a year earlier. Refinery demand for isobutane held up relatively well, as takings of isopentane contracted 80 percent. These changes resulted primarily from alterations in refinery processing incident to curtailment of aviation-gasoline production and expansion of commercial motor-fuel output.

Sales of liquefied petroleum gases for fuel and chemical purposes expanded vigorously through the fall and winter months, as expected, following release of these materials from wartime controls. Such sales in January 1946 were 24 million gallons (35 percent) above a year earlier and compensated in large part, from a volume standpoint, for the loss of markets at refineries.

Stocks did not change significantly until the first quarter of 1946, when they rose 54 percent to a total of 279,656,000 gallons. The major increment was in stocks of natural gasoline at plants and terminals east of California.

The severe decline in price quotations for natural gasoline between March 1945 and February 1946 (42 percent in Oklahoma and 49 percent at Breckenridge, Tex.), emphasized the arrival of a buyer's market in products of the natural-gasoline industry east of California. The material excess of potential supply over prospective markets under early peacetime conditions (discussed in the 1944 Natural Gasoline chapter) had its logical effect upon prices. However, there is little doubt that low prices will act promptly as a stimulant to sales for export and to jobbers and in some degree to refiners. Relative firmness in costs of competing fuels will aid this process. In the development of new markets for the liquefied gases, stress is being placed upon an increase in the summer load as a means of reducing the amplitude of seasonal fluctuations in consumption.

An important expansion in productive capacity of the industry over the next year or two is indicated by the large number of projects planned or already under construction. In view of the expected increase in output it is evident that, unless more of the products are absorbed by refiners, they will seek consuming markets directly and thus will provide increased competition for refinery gasoline and other commodities.

MARKET DEMAND

The total demand for products at natural-gasoline and cycle plants reached a new peak of 4,769,442 thousand gallons in 1945, an increase of 11 percent over 1944 and 35 percent over 1941.

The adjacent supply and distribution table is similar in form to the salient statistics table commented upon in the opening summary of this chapter. Liquefied-refinery-gas production and use are excluded, because this material originates at petroleum refineries. It will be noted that a more complete segregation by products is available for 1945.

Supply and distribution at plants of natural gasoline and allied products in the United States, 1944–45, by months, in thousands of gallons

	January	February	March	April	May	June	July	August	September	October	November	December	Total
1944													
Production:													
Natural gasoline and natural-gasoline mixtures	171,318	166,068	179,004	177,450	186,186	182,658	191,814	191,940	186,438	191,898	182,448	181,062	2,188,284
Liquefied petroleum gases:													
Isobutane	17,892	18,438	21,000	15,792	15,666	15,666	16,926	16,422	17,472	18,312	18,690	17,136	209,412
Other L. P. G	75,894	76,146	76,902	76,188	72,912	70,350	73,752	75,558	80,388	87,066	95,718	100,338	961,212
Other products	63,378	57,078	61,194	59,346	72,870	75,180	77,322	76,944	70,518	76,104	73,752	79,338	843,024
Total	328,482	317,730	338,100	328,776	347,634	343,854	359,814	360,864	354,816	373,380	370,608	377,874	4,201,932
Receipts from outside sources	6,342	5,964	8,274	10,626	8,778	8,106	7,896	7,266	10,248	11,508	12,810	14,364	112,182
Stock change at plants and terminals	+1,596	−2,772	+3,318	+3,444	+3,948	−7,686	−420	−6,048	−336	+2,562	+3,318	−126	+798
Total supply	333,228	326,466	343,056	335,958	352,464	359,646	368,130	374,178	365,400	382,326	380,100	392,364	4,313,316
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	157,491	159,734	160,187	163,150	171,680	174,288	179,076	182,307	178,137	180,782	179,844	174,309	2,060,985
Liquefied petroleum gases	36,039	34,025	41,383	39,050	38,922	41,039	45,650	49,319	49,368	54,744	53,457	51,278	534,274
Other products	42,327	39,301	48,636	45,439	54,352	59,112	59,518	59,432	54,203	56,241	53,563	57,825	629,949
To jobbers and trade outlets:													
Natural gasoline	11,181	10,992	12,060	11,369	11,703	9,447	9,614	8,027	7,466	8,744	9,118	8,887	118,608
Condensate, finished gasoline and naphtha	13,767	10,302	10,368	8,455	9,129	9,957	10,588	9,655	11,140	12,844	12,134	16,271	134,610
Liquefied petroleum gases:													
For fuel	53,759	55,823	52,196	50,197	48,902	46,501	43,497	42,425	45,379	48,995	54,826	66,381	608,881
For chemical manufacture	7,435	7,387	7,234	7,343	7,924	7,007	8,037	8,773	8,591	9,385	8,972	8,470	96,558
Transfers of cycle products	7,392	6,006	6,720	6,552	5,838	7,140	6,972	7,392	5,544	5,628	5,460	5,838	76,482
Exports, losses	3,837	2,896	4,272	4,403	4,014	5,155	5,178	6,848	5,572	4,963	2,726	3,105	52,969
Total demand at plants and terminals	333,228	326,466	343,056	335,958	352,464	359,646	368,130	374,178	365,400	382,326	380,100	392,364	4,313,316
1945 [1]													
Production:													
Natural gasoline and natural-gasoline mixtures	205,947	188,099	208,801	206,818	220,786	215,629	222,268	224,766	209,811	212,080	225,588	225,559	2,566,152
Raw condensate	42,513	35,632	38,519	35,661	36,563	34,113	34,308	32,429	23,045	33,171	30,109	32,270	408,333
Liquefied petroleum gases:													
Commercial butane-propane mixture	31,135	25,424	24,324	21,971	21,856	19,571	18,799	19,765	20,257	26,386	29,869	39,838	299,195
Normal butane	39,464	38,205	41,652	38,125	35,991	32,301	33,565	30,927	27,719	31,883	26,595	29,300	405,727
Propane	21,878	22,446	23,015	23,950	25,029	21,735	22,148	23,219	23,280	24,704	24,335	24,397	280,136
Other mixtures (L. P. G.)	11,734	11,562	13,264	13,829	17,474	16,090	16,303	15,734	8,632	12,011	10,941	12,499	160,073

Isobutane	15, 868	13, 229	14, 781	13, 669	14, 374	13, 885	14, 114	13, 849	11, 342	11, 668	13, 658	13, 252	163, 689
Isopentane	13, 237	12, 053	12, 911	12, 863	13, 075	12, 050	13, 084	11, 985	4, 488	2, 448	3, 743	1, 578	113, 515
Finished gasoline and naphtha	18, 552	17, 824	19, 265	18, 870	19, 423	21, 181	22, 185	20, 103	19, 374	22, 431	19, 768	22, 012	240, 988
Other products	3, 014	3, 158	3, 432	3, 076	3, 124	3, 231	2, 943	2, 470	1, 879	2, 361	3, 219	3, 792	35, 699
Total	403, 342	367, 632	399, 964	388, 832	407, 695	389, 786	399, 717	395, 247	349, 827	379, 143	387, 825	404, 497	4, 673, 507
Receipts from outside sources	11, 358	14, 699	10, 935	9, 789	8, 450	8, 282	8, 562	8, 050	9, 066	9, 778	11, 360	9, 745	120, 074
Stock change at plants and terminals	−2, 927	+10, 850	+536	+6, 826	+3, 348	−6, 773	−6, 530	−1, 112	+9, 338	−2, 046	+8, 890	+3, 739	+24, 139
Total supply	417, 627	371, 481	410, 363	391, 795	412, 797	404, 841	414, 809	404, 409	349, 555	390, 967	390, 295	410, 503	4, 769, 442
Shipments to refineries:													
Natural gasoline and natural-gasoline mixtures	198, 213	175, 624	199, 988	189, 751	207, 496	208, 866	216, 156	216, 944	198, 771	211, 375	211, 656	221, 169	2, 456, 009
Condensate	41, 644	34, 994	36. 888	35, 245	35, 778	33, 146	33, 446	31, 710	22, 181	31, 533	29, 044	30, 201	395, 810
Normal butane	21, 352	22, 198	24, 369	22, 638	20, 209	19, 155	20, 972	15, 780	10, 606	16, 163	10, 044	7, 751	211, 237
Isobutane	13, 625	13, 149	15, 240	13, 578	13, 579	13, 732	14, 293	14, 055	9, 950	9, 949	13, 101	11, 376	155, 627
Isopentane	12, 832	11, 654	12, 236	13, 275	14, 111	12, 453	12, 987	10, 192	6, 452	2, 515	2, 750	2, 449	113, 906
Other L. P. G	24, 840	21, 550	23, 159	21, 983	22, 893	21, 277	22, 149	21, 319	15, 174	16, 251	15, 122	12, 435	238, 152
Finished gasoline and naphtha	3, 308	3, 411	3, 147	2, 975	2, 987	2. 829	2, 114	1, 966	1, 536	1, 328	1, 229	1, 541	28, 371
To jobbers and trade outlets:													
Natural gasoline	9, 243	10, 316	10, 181	9, 588	9, 378	9, 120	9, 732	8, 091	6, 432	7, 492	6, 888	6, 179	102, 640
Condensate	907	864	1, 032	458	540	417	367	372	380	423	334	417	6, 511
Finished gasoline and naphtha	15, 236	13, 628	17, 657	16, 521	15, 900	19, 798	20, 170	17, 391	15, 117	17, 531	17, 936	18, 852	205, 737
Liquefied petroleum gases:													
For fuel	60, 116	51, 074	50, 112	47, 469	49, 357	42, 922	42, 143	42, 390	44, 655	55, 966	58, 479	71, 577	616, 260
For chemical manufacture	8, 699	7, 998	9, 258	10, 332	15, 385	15, 192	13, 629	15, 104	12, 444	14, 222	16, 381	17, 245	155, 889
Transfers of cycle products	3, 020	3, 060	3, 613	3, 468	3, 063	3, 200	3, 228	2, 341	1, 695	2, 136	3, 176	3, 658	35, 658
Exports and losses	4, 592	1, 961	3, 483	4, 514	2, 121	2, 734	3, 423	6, 754	4, 162	4, 083	4, 155	5, 653	47, 635
Total demand at plants and terminals	417, 627	371, 481	410, 363	391, 795	412, 797	404, 841	414, 809	404, 409	349, 555	390, 967	390, 295	410, 503	4, 769, 442

[1] Subject to revision.

Natural gasoline and allied products utilized at refineries in the United States, 1944–45, by districts and months, in thousands of gallons

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1944													
East Coast	6,090	1,260	8,988	6,804	4,956	6,762	7,980	8,106	7,350	8,232	11,676	8,862	87,066
Appalachian	1,932	1,596	1,596	1,344	1,344	1,302	1,218	1,218	1,260	1,386	1,512	1,512	17,220
Indiana, Illinois, Kentucky, etc.	28,602	27,720	29,484	29,316	30,744	28,056	28,644	28,770	33,516	39,102	34,944	35,364	374,262
Oklahoma, Kansas, and Missouri	18,648	13,188	16,716	16,338	16,674	15,918	15,918	18,228	17,220	15,792	19,278	19,782	203,700
Texas:													
Gulf Coast	65,814	50,484	65,604	52,080	59,598	71,862	90,342	88,620	78,666	77,280	78,120	71,652	850,122
Inland	29,946	31,122	25,830	28,518	31,206	28,266	28,518	24,360	23,940	30,996	33,558	31,164	347,424
Total Texas	95,760	81,606	91,434	80,598	90,804	100,128	118,860	112,980	102,606	108,276	111,678	102,816	1,197,546
Louisiana-Arkansas:													
Louisiana Gulf Coast	14,826	14,280	15,456	16,590	15,246	17,178	15,918	17,808	16,632	17,640	16,800	14,364	192,738
Arkansas and Louisiana Inland	6,048	4,830	5,586	4,788	5,418	5,250	7,770	7,182	6,552	6,468	6,636	7,728	74,256
Total Louisiana-Arkansas	20,874	19,110	21,042	21,378	20,664	22,428	23,688	24,990	23,184	24,108	23,436	22,092	266,994
Rocky Mountain	1,890	1,428	2,982	4,242	2,730	4,200	5,082	4,998	4,998	5,922	4,116	5,670	48,258
California	52,248	48,300	53,592	50,484	50,400	49,224	57,540	56,238	53,424	50,022	49,938	56,238	627,648
Total United States	226,044	194,208	225,834	210,504	218,316	228,018	258,930	255,528	243,558	252,840	256,578	252,336	2,822,694
1945 [1]													
East Coast	10,962	9,828	10,668	5,712	5,838	8,610	9,702	4,074	840	1,302	2,016	1,302	70,854
Appalachian	1,596	1,470	1,344	1,344	1,176	1,260	1,050	1,218	1,428	2,016	2,184	2,184	18,270
Indiana, Illinois, Kentucky, etc.	33,726	33,348	30,114	32,466	30,744	27,594	28,728	30,702	26,838	21,966	28,014	24,738	348,978
Oklahoma, Kansas, and Missouri	19,362	12,558	18,648	14,868	16,926	20,034	19,404	16,758	14,616	21,294	25,074	23,478	223,020
Texas:													
Gulf Coast	80,514	66,906	80,010	74,550	72,198	73,038	76,146	74,802	49,560	68,502	72,870	64,932	854,028
Inland	28,476	29,736	37,758	34,398	37,002	35,322	38,220	36,750	38,724	43,134	29,904	32,382	421,806
Total Texas	108,990	96,642	117,768	108,948	109,200	108,360	114,366	111,552	88,284	111,636	102,774	97,314	1,275,834
Louisiana-Arkansas:													
Louisiana Gulf Coast	16,086	12,894	9,870	10,332	11,844	13,524	18,396	16,212	7,560	7,686	7,854	7,392	139,650
Arkansas and Louisiana Inland	6,804	6,384	7,056	10,080	8,946	8,862	9,492	9,198	5,376	6,636	7,728	7,434	93,996
Total Louisiana-Arkansas	22,890	19,278	16,926	20,412	20,790	22,386	27,888	25,410	12,936	14,322	15,582	14,826	233,646
Rocky Mountain	3,948	3,360	6,258	5,292	5,964	6,636	6,216	6,678	6,342	4,452	3,906	4,032	63,084
California	66,486	52,710	56,070	66,192	66,150	59,850	67,788	65,520	62,118	53,298	48,300	55,440	719,922
Total United States	267,960	229,194	257,796	255,234	256,788	254,730	275,142	261,912	213,402	230,286	227,850	223,314	2,953,608

[1] Subject to revision.

Shipments to refineries.—Reported shipments to refineries amounted to 3,599,112 thousand gallons in 1945, or 12 percent more than in 1944. Of the total demand at plants, refinery shipments, either direct or through brokers, accounted for 75 percent in 1945 and 1944, compared with 77 percent in 1941. Although shipments of liquefied petroleum gases were 35 percent greater in 1945 than in 1944, they declined so rapidly with liquidation of the aviation-gasoline program that in the fourth quarter they averaged over 13 million gallons a month (25 percent) below the comparable 1944 period.

"Direct" sales.—Sales to jobbers and trade outlets expanded in the spring of 1945 and remained at relatively high levels for the remainder of the year. Such sales totaled 314,888 thousand gallons in 1945 compared with 253,218 thousand in 1944.

Percentage of natural gasoline and allied products in refinery gasoline in the United States, 1941–45, by districts

Year	East Coast	Appalachian	Indiana, Illinois, Kentucky	Oklahoma, Kansas, Missouri	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas and Louisiana Inland	Rocky Mountain	California	Total
1941	2.3	1.9	5.3	6.6	17.6	5.6	3.7	6.1	4.4	16.1	7.1
1942 [1]	1.4	2.1	5.8	6.3	16.0	13.9	13.1	11.6	4.8	16.7	9.6
1943 [1]	1.1	1.9	6.0	8.6	21.2	14.2	18.3	12.9	4.0	15.0	10.3
1944 [1]	2.3	1.7	6.3	7.1	17.8	11.6	12.6	16.5	5.7	13.6	9.3
1945 [1] [2]	1.7	1.7	5.8	7.3	20.5	10.9	7.5	19.3	6.9	14.2	9.1

[1] 1942–45: Not comparable with prior years because relatively more liquefied petroleum gas is included.
[2] Subject to revision.

Sales of liquefied petroleum gases for fuel use in the first 9 months of 1945 were smaller than in the same 1944 period, but in the fourth quarter exceeded the 1944 rate by 9 percent. The most conspicuous growth was shown in sales for use as raw material in chemical manufacture. The rate in December 1945 was more than double that of a year earlier, and the total of 155,889 thousand gallons for 1945 was 61 percent above 1944. The manufacture of chemicals from liquefied petroleum gases is expected to increase very greatly in the next few years as the results of wartime and later research are applied to commercial operations.

Exports.—An expansion in exports, chiefly in the last 5 months, raised the total in 1945 to 62,833,000 gallons, an increase of 47 percent over 1944. Natural-gasoline exports increased from 28,222,000 gallons valued at $2,082,000 in 1944 to 36,912,000 gallons valued at $2,293,000 in 1945. Liquefied-petroleum-gas shipments almost doubled, rising from 14,480,000 gallons valued at $783,753 in 1944 to 25,921,000 gallons valued at $1,589,000 in 1945.

The principal countries of destination in 1945 and amounts received were: Canada 49,860,000 gallons, Mexico 12,556,000, Portugal 97,000, and Brazil 63,000.

STOCKS

Total stocks of products were relatively stable in 1945, decreasing only from 186,942 thousand gallons on January 1 to 181,513 thousand gallons on December 31. Inventories at refineries, however, declined

717372—47——76

almost 30 million gallons, continuing the 1944 trend, as holdings at plants and terminals rose 24 million gallons.

Year-end inventories of natural gasoline at refineries were the lowest in recent years, amounting to only half of such stocks in 1943 and about one-third of the quantity held at the end of 1941. Liquefied petroleum gases at refineries declined more than 50 percent after reaching a peak of 41,622 thousand gallons on May 31, 1945. Stocks of all types of light products at plants and terminals increased during 1945.

Stocks of natural gasoline and allied products in the United States, 1941–44 and 1945, by months, in thousands of gallons

Date	Natural gasoline		Liquefied petroleum gases		Other products		Total	
	At plants and terminals	At refineries	At plants and terminals	At refineries	At plants and terminals	At refineries	At plants and terminals	At refineries
Dec. 31:								
1941	72,282	98,994	[1] 4,914	[1] 1,890	8,274	(2)	[1] 85,470	[1] 100,884
1942	91,938	65,436	11,928	11,718	10,920	2,604	114,786	79,758
1943	61,488	68,922	15,750	29,274	10,332	4,956	87,570	103,152
1944	60,060	54,642	17,262	29,190	11,046	6,384	88,368	90,216
1945								
Jan. 1	60,060	54,642	17,262	29,190	11,046	[3] 14,742	88,368	[3] 98,574
Jan. 31	55,520	48,468	17,884	24,822	12,037	16,002	85,441	89,292
Feb. 28	62,882	47,082	20,224	33,348	13,185	17,220	96,291	97,650
Mar. 31	63,628	51,408	21,530	33,180	11,669	13,650	96,827	98,238
Apr. 30	71,369	45,906	21,686	37,338	10,598	13,986	103,653	97,230
May 31	75,683	44,940	20,228	41,622	11,090	11,088	107,001	97,650
June 30	72,331	46,410	17,578	34,776	10,319	16,968	100,228	98,154
July 31	67,272	40,614	16,514	33,264	9,912	14,616	93,698	88,494
Aug. 31	62,338	36,246	19,599	25,746	10,649	15,456	92,586	77,448
Sept. 30	67,142	34,566	20,720	19,152	14,062	11,718	101,924	65,436
Oct. 31	60,369	33,768	20,937	19,026	18,572	13,608	99,878	66,402
Nov. 30	69,737	38,598	19,572	19,740	19,459	14,532	108,768	72,870
Dec. 31	67,412	34,314	22,255	17,262	22,840	17,430	112,507	69,006

[1] New basis for comparison with 1942.
[2] Not available.
[3] New basis for comparison with 1945.

TECHNOLOGIC DEVELOPMENTS

Cycle plants.—Total liquid production at cycle plants in 1945 was about 1,221 million gallons (29 million barrels), or 26 percent of the entire natural-gasoline industry. As a great many condensate fields exist to which cycling has not yet been applied, a large increase in these operations may be anticipated when economic conditions permit. A large new cycle plant in the Sheridan field, Colorado County, Tex., was in the final stage of construction late in 1945.

Yields.—As the average yield of all light products has increased from 1.22 gallons per thousand cubic feet of gas processed in 1942 and 1943 to 1.27 gallons in 1944 and 1.32 gallons in 1945, the yield of natural gasoline and "other products" has remained at 0.92 gallon since 1942. The recovery of liquefied petroleum gases has therefore progressively grown from 0.27 gallon per thousand cubic feet in 1942 to 0.40 gallon in 1945, reflecting the operation of added facilities for recovery and fractionation of light ends.

Production by processes.—The total number of operating plants wa 610 in 1944 compared with 642 in 1943, continuing the long-term trend toward fewer active plants. Compression plants numbered 190, a net loss of 25 since 1943 (including 11 in Illinois and 8 in Pennsylvania). Eleven absorption plants (5 in California) ceased operating and 4 were added, resulting in a net loss of 7. Three cycle plants were added in Louisiana, and 1 was removed from the active list in Texas.

The average liquid production per plant in 1944 was 6,888 thousand gallons, compared with 5,738 thousand in 1943 and 5,024 thousand in 1941. Average plant production by type of plant in 1944, in thousands of gallons, was: Compression 1,124, absorption 7,755, cycle 29,201.

The Paloma cycle plant in California commenced operation in June 1944 but is not included in the table of plants because until 1945 its production of debutanized condensate was reported as crude petroleum.

Natural gasoline and allied products produced in the United States in 1944, by States and by methods of manufacture [1]

State	Number of plants operating				Production (thousands of gallons)			
	Compression [2]	Absorption [3 4 5]	Cycling [6]	Total	Compression [2]	Absorption [3 4 5]	Cycling [6]	Total
Arkansas		12		12		75, 536		75, 536
California		79		79		771, 280		771, 280
Colorado						[7] 310		[7] 310
Illinois	18	7		25	897	193, 472		194, 369
Kansas	2	10		12	1, 521	68, 313		69, 834
Kentucky	1	3		4	859	47, 883		48, 742
Louisiana	3	26	5	34	2, 937	137, 352	352, 370	492, 659
Michigan	1	1		2	7.658	842		8, 500
Montana		1		1		4, 768		4, 768
New Mexico	2	7		9	2, 051	79, 110		81, 161
New York	1			1	12			12
Ohio	2	8		10	6	7, 276		7, 282
Oklahoma	22	79		101	23, 454	398, 314		421, 768
Pennsylvania	56	11		67	1, 635	15, 860		17, 495
Texas	29	113	30	172	149, 706	1, 050, 131	669, 658	1, 869, 495
Utah						[7] 924		[7] 924
West Virginia	51	24		75	22, 176	66, 741		88, 917
Wyoming	2	4		6	700	48, 180		48, 880
Total: 1944	190	385	35	610	213, 612	2, 966, 292	1, 022, 028	4, 201, 932
1943	215	394	33	642	246, 237	2, 700, 625	737, 210	3, 684, 072

[1] Figures for 1945 not yet available.
[2] Includes 18 plants manufacturing liquefied petroleum gases.
[3] Includes combination of absorption process with compression and charcoal processes.
[4] Includes 163 plants manufacturing liquefied petroleum gases.
[5] Includes 3 charcoal plants in West Virginia with 3,770,000 gallons production in 1944 and 5 charcoal plants (1 in Pennsylvania and 4 in West Virginia) with 2,324,000 gallons production in 1943.
[6] Includes 21 plants manufacturing liquefied petroleum gases.
[7] Drip gasoline.

Technical trends.—Recent emphasis upon conservation of natural gas produced with oil, stimulated by the current investigation of the natural-gas industry by the Federal Power Commission, indicates that increasing amounts of casinghead gas will be processed for extraction of liquids and returned to petroleum reservoirs, primarily to improve the efficiency of oil recovery.

The most revolutionary development in imminent prospect will be tested commercially in a plant now under construction at Brownsville in South Texas. This plant is designed to convert dry natural gas into a variety of petroleum products by chemical reorganization, at costs that are claimed to be competitive with those of petroleum refineries. The production from coal, at low cost, of a gas comparable in quality to natural gas is also indicated as a possibility of the process. Because commercial application of these new techniques and discoveries could profoundly influence the future of the fuel industries, they will be studied closely and with keen interest by all concerned.

LIQUEFIED PETROLEUM GASES; SALES SURVEY

Sales of liquefied petroleum gases increased from a revised total of 1,060,156,000 gallons in 1944 to 1,276,766,000 in 1945—a gain of over 20 percent. If material delivered for synthetic rubber components is omitted in order to arrive at totals comparable with those of former years, the gain in sales was about 19 percent in 1945 (1,067,979,000 gallons in 1945 and 898,071,000 in 1944) compared with increases of 33 percent in 1944 and 15 percent in 1943. The ending of the war in the latter part of 1945 released some liquefied petroleum gases for civilian consumption; however, shortages of equipment for transportation and use of these gases continued, and consequently potential markets were not fully supplied.

Sales of liquefied petroleum gases in the United States, 1938–45, in thousands of gallons

Year	Butane	Propane	Butane-propane mixtures	Pentane	Total	
					Quantity	Percent of increase over preceding year
1938	52,768	54,130	56,050	2,253	165,201	16.8
1939	71,351	79,323	69,020	3,886	223,580	35.3
1940	77,056	109,216	123,348	3,836	313,456	40.2
1941	112,244	126,969	219,252	4,387	462,852	47.7
1942	128,560	150,511	301,917	4,452	585,440	26.5
1943	140,122	218,273	312,683	4,155	675,233	15.3
1944 [1] [2]	122,870	324,355	450,846	(3)	898,071	33.0
1944 [2] [4]	273,116	335,884	451,156	(3)	1,060,156	
1945 [5]	325,140	444,581	507,045	(3)	1,276,766	20.4

[1] Without synthetic rubber components for comparison with 1943.
[2] Revised. [3] Not available. [4] Includes material delivered for synthetic rubber components.
[5] Subject to revision.

All uses of liquefied petroleum gases showed substantial gains in 1945 over 1944 except quantities reported for industrial consumption and internal-combustion-engine fuel. Distributors delivered 533,262,000 gallons for domestic use (household consumption) in 1945—a 20-percent gain over the 1944 demand of 445,617,000 gallons. It should be noted that the 1945 rate of expansion for domestic requirements was somewhat below that recorded for 1944—29 percent; furthermore, the annual percentage of increase is again headed downward, as it was in 1942 and 1943. Incidentally, deliveries of liquefied petroleum gases for domestic fuel represented about 42 percent of total sales for all purposes in both 1944 and 1945. Quantities of liquefied petroleum gases credited to manufactured-gas companies—constituting about 4 percent of all demands—have been trending upward steadily in recent years, and the 1945 total (53,849,000 gallons) was 17 percent above 1944 requirements (45,879,000 gallons) and more than double the 1941 item (25,255,000 gallons).

Liquefied petroleum gases diverted for the manufacture of synthetic rubber increased from 162,085,000 gallons in 1944 to 208,787,000 in 1945—a 29-percent gain. The 1945 quantity represented about 16 percent of all deliveries of liquefied petroleum gases compared with a 15-percent share in 1944. Chemical-manufacturing plants use liquefied petroleum gases as raw material, and the requirements have mounted to important items in the late war years—increasing from 151,985,000 gallons in 1944 to 224,291,000 in 1945—a 48-percent increment. Sales of liquefied petroleum gases credited to chemical plants forged ahead of the synthetic rubber total in 1945; furthermore, the proportionate share to be used for chemical raw material rose to about 18 percent of all deliveries in 1945 compared with 14 percent of the total in 1944.

Sales of liquefied petroleum gases for industrial fuel in 1945—163,121,000 gallons—differed little from 1944 requirements—162,018,000 gallons. The small increase in this demand in 1945 reflects not only the sudden tapering off in the war industries toward the close of the year but is also partly the result of transportation and equipment difficulties connected with the distribution and use of this fuel. It can be added that liquefied petroleum gases sold to industrial plants dropped from 15 percent of total market deliveries in 1944 to a 13-percent proportion in 1945. Distributors reported 93,340,000 gallons of liquefied petroleum gases diverted for internal-combustion-engine fuel in 1945—a 1-percent gain over 1944 requirements of 92,495,000 gallons. This small increase is well below the gains of 7 and 5 percent indicated, respectively, for 1943 and 1944. Butane-propane mixtures are used predominantly for internal-combustion-engine fuel, and the strong competitive demands for these "mixtures" for domestic fuel and chemical raw material were evidently factors that tended to limit quantities available for engine fuel. Lack of internal-combustion-engine equipment and maintenance difficulties also retarded the increase in demand for liquefied petroleum gases as fuel.

The proportionate share of butane in the annual sales of liquefied petroleum gases has declined steadily in recent years owing to war restrictions and the diversion of important quantities for the manufacture of motor fuel and synthetic rubber. Butane, not including quantities reported as synthetic rubber components, represented less than 14 percent of all sales of liquefied petroleum gases in 1944 and 1945, as compared with a 24-percent share in 1941 and a 22-percent share in 1942. If material sold to rubber plants is included, the butane item increases to about 26 percent of total sales in both 1944 and 1945. Fuel uses formerly satisfied with butane have been shifted largely to propane and to a lesser extent to butane-propane mixtures. The relative quantity of propane in the annual sales has expanded steadily from a 26-percent share in 1942 to a 39-percent proportion in 1945, while the percentage for "mixtures" has fluctuated during the same interval but has averaged about 50 percent of annual requirements for these liquid gases. Incidentally, the percentage for "mixtures" dropped from 50 percent of total sales in 1944 to 47 percent of the comparative 1945 item. When liquefied petroleum gases used as raw material for the manufacture of synthetic rubber are added to the totals, propane made up 32 percent of all deliveries in 1944 and 35 percent in 1945, while for the "mixtures" the proportion dropped from about 43 percent in 1944 to 40 percent in 1945.

The demand for butane, including synthetic rubber components, increased by 19 percent from 273,116,000 gallons in 1944 to 325,-140,000 in 1945. If sales of butane to rubber plants are omitted, the 1945 total is 143,283,000 gallons, a 17-percent gain over 1944 requirements of 122,870,000 gallons. Although less butane was used as industrial fuel in 1945 than in 1944, all other uses made gains as restrictions pertaining to this fuel were lifted or modified. Butane reported for domestic fuel, which has declined steadily in quantity since 1942, rebounded to a record volume in 1945, when the total—52,866,000 gallons—was nearly double 1944 deliveries—27,565,000 gallons—and well above the previous record of 45,028,000 gallons sold in 1942. Sales of butane for domestic fuel uses represented 16 percent of the butane total in 1945 compared with a 10-percent share in 1944. During recent years butane has become an important raw material for making synthetic rubber, and this one use alone has accounted for about 55 percent of total butane sales. Quantitatively, requirements for this purpose have increased from 150,246,000 gallons in 1944 to 181,857,000 in 1945—a 21-percent gain. Butane reported as raw material for chemical plants has also shown a steady increase in recent years and has expanded from 5,256,000 gallons in 1942 to 23,475,000 in 1944 and to 26,227,000 in 1945.

Sales of butane to manufactured-gas companies dropped noticeably in 1944, yet they recovered somewhat in 1945, when requirements (15,637,000 gallons) were 5 percent over the 1944 total—14,900,000 gallons; however, the 1945 quantity is still well below the 1943 item—21,829,000 gallons. The industrial demand for butane in 1945 was the only principal use to show a shrinkage, when requirements (42,-043,000 gallons) were about 21 percent below the 1944 total (52,-890,000 gallons). The growing use of propane as an industrial fuel, competitive demands for butane as a raw material and a domestic fuel, and the slow-down in activities in the latter part of 1945 were all factors that tended to reduce the quantity of butane sold as an industrial fuel. The quantities of butane reported as internal-combustion-engine fuel have dwindled noticeably during the war years; however, a gain was indicated in 1945, when deliveries for direct use as motor fuel increased to 6,469,000 gallons compared with 4,030,000 in 1944.

Distributors sold 418,055,000 gallons of propane in 1945, a 29-percent gain over the 1944 quantity (324,355,000 gallons). When the propane delivered to rubber plants is added, the 1945 propane total is 444,581,000 gallons or 32 percent over the comparative 1944 demand—335,884,000 gallons. All uses of propane showed important gains in 1945. About half of the propane is reported as domestic fuel, and these deliveries increased by 29 percent from 167,450,000 gallons in 1944 to 216,415,000 in 1945. The use of propane as an industrial fuel has expanded greatly in recent years, replacing butane and "mixtures," which in turn were diverted to other uses. Sales of propane to industrial plants expanded from 20,601,000 gallons in

1942 to 105,040,000 in 1945. It should be added that the 1945 demand was 13 percent above the 1944 total—93,040,000 gallons.

Chemical plants are using greatly increased quantities of propane as raw material, as indicated by purchases of 4,455,000 gallons in 1943, 40,666,000 in 1944, and 66,776,000 in 1945. The 1945 quantity was a 64-percent gain over the 1944 total and from another angle the 1945 chemical item represented 16 percent of the total demand for propane compared with a 13-percent share in 1944. The volume of propane diverted to synthetic rubber plants for use as raw material is not relatively important; however, the total more than doubled from 11,529,000 gallons in 1944 to 26,526,000 in 1945.

Sales of propane to manufactured-gas companies have expanded rapidly in recent years, and the 1945 total (22,323,000 gallons) is 31 percent above the 1944 demand (17,103,000 gallons) and over four times 1942 requirements—4,957,000 gallons. Relatively little propane—about 2 percent of the annual total—is reported as fuel for internal-combustion engines; however, this particular use mounted by 23 percent from 6,085,000 gallons in 1944 to 7,453,000 in 1945.

Deliveries of butane-propane mixtures, including negligible amounts sold to synthetic rubber plants, increased from 451,156,000 gallons in 1944 to 507,045,000 in 1945—a gain of 12 percent. More than half of these totals (56 percent in 1944 and 52 percent in 1945) were reported as domestic fuel, which rose quantitatively from 250,602,000 gallons in 1944 to 263,981,000 in 1945—an increase of 5 percent. Chemical plants use important volumes of "mixtures" in their processes, and their purchases of this raw material have skyrocketed from 38,325,000 gallons in 1942 to 131,288,000 in 1945. Incidentally, the latter quantity was nearly 50 percent over the 1944 demand of 87,844,000 gallons. The use of "mixtures" as fuel for internal-combustion engines ranks third in relative volume; however, deliveries for this purpose have fluctuated from 64,470,000 gallons in 1942 to 82,380,000 in 1944 and down to 79,418,000 in 1945—a loss of 4 percent for the last year.

Sales of "mixtures" for industrial fuel, totaling 16,038,000 gallons in 1945, differed little from the 1944 quantity—16,088,000 gallons. Butane-propane mixtures, as an industrial fuel, have lost ground to propane in recent years, and present demands are well below peak requirements of 43,011,000 gallons reported for 1942. "Mixtures" delivered to manufactured-gas companies reached a "high" of 15,889,000 gallons in 1945—a 15-percent gain over the 1944 total—13,876,000 gallons.

In recent years large quantities of butane were diverted from normal markets to plants for the manufacture of aviation gasoline, synthetic rubber, and chemical products. The effect of this shift of butane to other channels is clearly indicated if the relative proportions of the various liquid gases reported for the principal uses are reviewed. Butane delivered for domestic fuel declined from 15 percent of the total demand in 1941 to a 6-percent share in 1944. The pressure for butane for use as raw material and industrial fuel was lightened in the latter part of 1945, and with this change in the market it is noticed that the butane share in the domestic fuel total rose to 10 percent. The percentage of propane sold for household

Sales of liquefied petroleum gases in the United States, 1944–45, by uses, methods of transportation, and regional distribution, in thousands of gallons

	Butane	Propane	Butane-propane mixtures	Total	
				Quantity	Percent
1944 [1]					
By uses:					
Domestic	27,565	167,450	250,602	445,617	42.0
Gas manufacturing	14,900	17,103	13,876	45,879	4.3
Industrial fuel	52,890	93,040	16,088	162,018	15.3
Synthetic rubber components	150,246	11,529	310	162,085	15.3
Chemical manufacturing	23,475	40,666	87,844	151,985	14.4
Internal-combustion-engine fuel	4,030	6,085	82,380	92,495	8.7
All other uses	10	11	56	77	
	273,116	335,884	451,156	1,060,156	100.0
Percent of total	25.8	31.7	42.5	100.0	
Regional distribution:					
Pacific Coast area	14,569	47,925	104,419	166,913	15.7
All other areas	258,547	287,959	346,737	893,243	84.3
	273,116	335,884	451,156	1,060,156	100.0
1945 [2]					
By uses:					
Domestic	52,866	216,415	263,981	533,262	41.8
Gas manufacturing	15,637	22,323	15,889	53,849	4.2
Industrial fuel	42,043	105,040	16,038	163,121	12.8
Synthetic rubber components	181,857	26,526	404	208,787	16.3
Chemical manufacturing	26,227	66,776	131,288	224,291	17.6
Internal-combustion-engine fuel	6,469	7,453	79,418	93,340	7.3
All other uses	41	48	27	116	
	325,140	444,581	507,045	1,276,766	100.0
Percent of total	25.5	34.8	39.7	100.0	
Regional distribution:					
Pacific Coast area	17,396	53,330	116,485	187,211	14.7
All other areas	307,744	391,251	390,560	1,089,555	85.3
	325,140	444,581	507,045	1,276,766	100.0

[1] Revised.
[2] Subject to revision.

consumption dropped from 44 percent in 1941 to about 37 percent in 1943, and there was a corresponding rise in the relative percentage of "mixtures" sold for this particular purpose. There was a slight increase (to 38 percent) in the relative proportion of propane reported as domestic fuel in 1944; this upward trend continued into 1945 to a 41-percent share. The declining percentages for butane and propane in the domestic-fuel market in the war years were counteracted by a pronounced rise for "mixtures," which went from about 40 percent of the total demand in 1941 to 56 percent in 1944. The percentage gains for butane and propane in the 1945 domestic requirement were reflected in a drop to a 50-percent share for butane-propane mixtures.

The relative percentages for the liquefied gases sold to gas-manufacturing companies have fluctuated for several years; however, over this time there has been a net drop for butane from 48 percent of the 1941 total to a 29-percent share of the 1945 demand. The propane reported for gas-company use dropped sharply from 27 percent in 1941 to 16 percent in 1942. Nevertheless, there has been a steady increase since that year to a 42-percent proportion in 1945. The percentage for butane-propane mixtures in the manufactured-gas-company total has mounted from 25 percent in 1941 to 30 percent in 1945. However, the percentage share for "mixtures" reached about 45 percent in 1942;

the proportions for both butane and propane were down sharply in that particular year.

In recent years industrial plants using liquefied petroleum gases for fuel purposes have made a pronounced shift from butane and butane-propane mixtures to propane. In 1941 nearly half (47 percent) of the fuel for this principal use was reported as butane; however, this proportion has steadily shrunk to a 26-percent share in 1945 because of changed market conditions prevailing during the interval. The relative proportion of butane-propane mixtures consumed by industrial plants has likewise dwindled from 36 percent of the total demand in 1941 to 10 percent of the requirements in both 1944 and 1945. Conversely, propane delivered for industrial fuel has jumped from 17 percent of the total in 1941 to over a 64-percent share in 1945.

Most of the liquefied petroleum gases delivered as raw material for making synthetic rubber were reported as butane—93 percent of the total demand in 1944 and 87 percent in 1945—while propane made up all of the balance, except for insignificant quantities of "mixtures." In 1941 butane-propane mixtures comprised nearly 90 percent of the total liquefied petroleum gases used as raw material by chemical plants. Pentane satisfied about 7 percent of this particular market at the time, while butane and propane were unimportant. There have been some changes during recent years, as butane and propane have become more in demand for use as chemical raw material at the expense of "mixtures." As a result, butane was reported as making up about 12 percent of the 1945 demand, and propane mounted to a 30-percent share for the same period, while the relative proportion for butane-propane mixtures slumped to 58 percent of total requirements for both 1944 and 1945.

There were restrictions on the use of butane as internal-combustion-engine fuel during the war period; consequently, its proportionate utilization for this purpose declined from 28 percent in 1941 to 4 percent in 1944. As regulations were modified in late 1945, butane rose to 7 percent of the total for that year. On the other hand, as butane became less available for direct motor-fuel use, the demand was shifted to butane-propane mixtures, the proportion of which went from 70 percent in 1941 to 89 percent in 1944. The percentage for "mixtures" in the motor-fuel total dropped to 85 percent in 1945, as more butane became available. Propane has never been an important fuel for internal-combustion engines; however, the percentage for this liquid gas expanded from 2 percent of the 1941 total demand to 8 percent in 1945.

E. T. Knudsen of the Los Angeles office of the Bureau of Mines reported the distribution of 187,211,000 gallons of liquefied petroleum gases in the Pacific Coast marketing area (California, Oregon, Washington, Arizona, and Nevada) in 1945—a 12-percent gain over a revised total of 166,913,000 for 1944. The liquefied petroleum gases delivered in the Pacific Coast area represented 15 percent of the national total in 1945 compared with a 16-percent share in 1944. Marketers in all other parts of the country sold 1,089,555,000 gallons of liquefied petroleum gases in 1945, an increase of 22 percent over the 1944 demand—893,243,000 gallons.

CARBON BLACK

By F. S. LOTT AND H. BACKUS

SUMMARY OUTLINE

SUMMARY

Production and sales of carbon black rose to new peaks above 1 billion pounds in 1945. The 31-percent gain in production to 1,052,-798,000 pounds sufficed to exceed the demand for the first time since 1942, as sales increased only 9 percent over 1944 to 1,020,035,000 pounds. Producers' stocks continued at minimum levels until the end of hostilities in August, subsequently rising to 102,005,000 pounds on December 31, 1945, compared with 69,243,000 at the end of 1944.

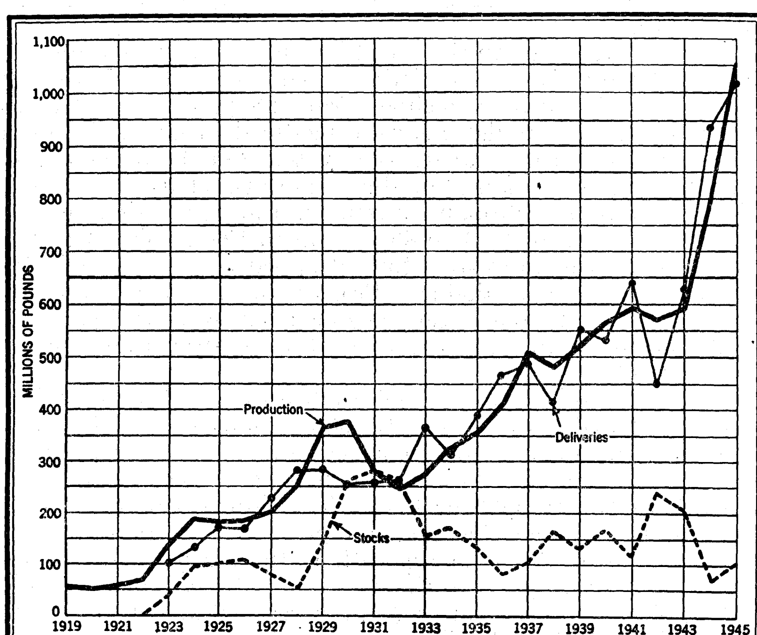

FIGURE 1.—Production, stocks, and deliveries of carbon black, 1919–45.

Demand in the early months of 1945 was so large in comparison with current supply that stringent measures were required to restrict consumption through tighter allocation controls and reduction by about 10 percent below current practice of the quantity of black permitted per tire manufactured. Price increases to high-cost plants were allowed in March and April to encourage larger output. In May, production and demand were in balance for the first time in many months, and thereafter a progressively easier situation made possible removal of restrictions upon consumption, beginning in June.

Salient statistics of carbon black produced from natural gas in the United States, 1941–45

	1941	1942	1943	1944	1945
Number of producers reporting	21	21	21	22	21
Number of plants	49	50	54	54	59
Quantity produced:					
By States and districts:					
Louisiana pounds	78,050,000	90,353,000	109,609,000	160,019,000	168,229,000
Texas:					
Panhandle district do	415,001,000	380,536,000	345,447,000	401,556,000	541,464,000
Rest of State do	65,211,000	54,353,000	61,898,000	99,606,000	179,974,000
Total Texas do	480,212,000	434,889,000	407,345,000	501,162,000	721,438,000
Other States do	35,803,000	48,764,000	76,467,000	140,679,000	163,131,000
Total United States do	594,065,000	574,006,000	593,421,000	801,860,000	1,052,798,000
By processes:					
Contact processes [1] do	492,857,000	428,665,000	379,923,000	414,676,000	538,539,000
Furnace processes do	101,208,000	145,341,000	213,498,000	387,184,000	514,259,000
Stocks held by producers Dec. 31:					
Contact types pounds	(2)	(2)	196,913,000	58,036,000	64,956,000
Furnace types do	(2)	(2)	8,302,000	11,207,000	37,049,000
Total do	118,847,000	242,755,000	205,215,000	69,243,000	102,005,000
Losses do	61,000	167,000	1,661,000	402,000	1,000
Quantity sold:					
Domestic deliveries—					
To rubber companies do	439,502,000	295,947,000	473,473,000	738,029,000	804,386,000
To ink companies do	28,198,000	19,233,000	23,530,000	24,479,000	22,824,000
To paint companies do	5,840,000	3,616,000	3,945,000	5,315,000	7,421,000
For miscellaneous purposes do	23,039,000	15,500,000	23,440,000	[3] 12,616,000	11,631,000
Total domestic deliveries do	496,579,000	334,296,000	524,388,000	[3] 780,439,000	846,262,000
Export do	148,165,000	115,635,000	104,912,000	[3] 156,991,000	173,773,000
Total sold do	644,744,000	449,931,000	629,300,000	937,430,000	1,020,035,000
Value (at plants) of carbon black produced:					
Total	$19,341,000	$19,547,000	$20,248,000	$29,411,000	$42,323,000
Average per pound cents	3.26	3.41	3.41	3.67	4.02
Estimated quantity of natural gas used M cubic feet	365,377,000	335,533,000	315,562,000	355,770,000	431,830,000
Average yield of carbon black per M cubic feet pounds	1.63	1.71	1.88	2.20	2.32
Average value of natural gas used per M cubic feet cents	1.13	1.29	1.47	1.62	2.28

[1] Principally channel. [2] Figures not available. [3] Revised figures.

A reduction in requirements for military tires was followed in June by a downward adjustment in scheduled production of tires, and consumption of carbon black was temporarily curtailed by widespread strikes at rubber-processing plants in October. Shortages of drying oils and resins throughout 1945 tended to limit the use of carbon black by the paint and ink trades. Reconversion of the automotive industry to civilian products created in November a large demand for high-color-type blacks for use in automobile coatings that continued into 1946. The total demand for carbon black appeared to be running above 100 million pounds per month early in 1946 and increasing to cause a renewed decline in producers' stocks, particularly of channel types.

The production of contact-process blacks increased 30 percent over 1944 to a new record of 538,539,000 pounds, 8 percent above the former peak of 1940. A gain of 33 percent in furnace-black output to 514,259,000 pounds in 1945, or 49 percent of total black production, failed to surpass the expanded output of contact types.

Sales to rubber companies continued to dominate the domestic market, amounting to 95 percent of domestic sales in 1944 and 1945. Exports of 173,773,000 pounds in 1945 were 11 percent above 1944, owing to increased shipments after the surrender of Japan.

RECONVERSION

Reconversion of the carbon-black industry to normal peace conditions will be slow compared to many other segments of the economy because of delays in availability of natural rubber in quantity and the many technical, economic, and political problems that will impinge upon the future course of the rubber industry, the largest consumer of carbon black. Few industries have experienced such revolutionary changes in technical background in a brief period of years, or have been so effectively impressed upon public and official minds as an essential part of our industrial organization in peace and war, as the rubber industry. The wartime research in rubber and carbon black and appraisal of the industries' needs and public functions will fundamentally influence the future selection of raw materials and the scope of productive activity. The pattern, however, is intricate; many of its lines must be drawn by the industries themselves, others by the Federal Government, and still others by events in foreign countries.

According to the Civilian Production Administration, United States consumption of rubber in 1945 increased 8 percent over 1944 to 1,040,045 tons, of which 105,429 tons were natural rubber, 693,580 tons synthetic, and 241,036 tons reclaimed. Carbon-black sales to rubber companies, after deducting an estimate of 100 million pounds for use in reclaimed rubber, were 898 pounds per ton of virgin rubber consumed in 1944 and 882 pounds in 1945, although a higher percentage of synthetic rubber was used in 1945. Assuming a 1946 consumption of 600,000 tons of synthetic and 300,000 tons of natural rubber in the United States, domestic requirements of carbon black for rubber manufacture would approximate 800 million pounds. The expectation of a record volume of exports in 1946 seems justified, and an expansion of carbon-black consumption by other domestic trades than rubber processing.

Development of a light-colored substitute for carbon black was announced by the B. F. Goodrich Co. in May 1946. The material is produced by processing silica and alcohol and is particularly adaptable to the manufacture of colored rubber articles, in which the pigmentation of carbon black is undesirable. Present costs are much above those of carbon black, but volume production is expected to reduce costs to a competitive level, for at least some purposes.

Summary of statistics for carbon black produced from natural gas in the United States, 1941–45

Year	Production (thousands of pounds)	Value (thousands of dollars)	Stocks at end of year (thousands of pounds)	Sales (thousands of pounds)		Average yield (pounds per M cubic feet of gas)
				Domestic	Export	
1941	594,065	19,341	118,847	496,579	148,165	1.63
1942	574,006	19,547	242,755	334,296	115,635	1.71
1943	593,421	20,248	205,215	524,388	104,912	1.88
1944	801,860	29,411	69,243	[1] 780,439	156,991	2.20
1945	1,052,798	42,323	102,005	846,262	173,773	2.32

[1] Revised figures.

PRODUCTION

By States.—Production of 721,438,000 pounds of carbon black in Texas in 1945 exceeded the 1944 record by 44 percent. The Panhandle output gained 35 percent over 1944 and the remainder of the State 81 percent, reflecting new capacity, chiefly in West Texas. Of the total output of carbon black, Texas supplied 69 percent in 1945, compared with 62 percent in 1944, reversing a 6-year decline in this proportion.

Louisiana production increased 5 percent over the 1944 record to 168,229,000 pounds, although one less plant operated than in 1944. Although one new plant began to produce in Oklahoma, output declined from 53,887,000 pounds in 1944 to 53,192,000 pounds in 1945. Larger operations in New Mexico raised the output of the California-Kansas-New Mexico group 27 percent to 109,939,000 pounds in 1945.

Referring to the production graph in figure 2, the curve for "Other Texas" includes a small output from Oklahoma and Wyoming in 1932–35, inclusive.

Carbon black produced from natural gas in the United States in 1945, by States and by major producing districts

State and district	Producers reporting [1]	Number of plants	Production: Pounds	Production: Value at plant: Total	Production: Value at plant: Average (cents)	Natural gas used: M cubic feet	Natural gas used: Average yield per M cubic feet of gas (pounds)	Natural gas used: Value: Total	Natural gas used: Value: Average per M cubic feet (cents)
California	1	1							
Kansas	2	2	109,939,000	$4,216,000	3.83	28,734,000	3.83	$1,039,000	3.62
New Mexico	3	3							
Louisiana	6	6	168,229,000	5,922,000	3.52	23,209,000	7.25	631,000	2.72
Oklahoma	3	4	53,192,000	1,987,000	3.74	8,170,000	6.51	327,000	4.00
Texas:									
Panhandle district	15	32	[2] 541,464,000	22,161,000	4.09	309,475,000	1.59	5,897,000	1.91
Rest of State	4	11	179,974,000	8,037,000	4.47	62,242,000	2.89	1,960,000	3.15
Total Texas	[1] 15	43	[2] 721,438,000	30,198,000	4.19	371,717,000	1.80	7,857,000	2.11
Total United States	[1] 21	59	[2] 1,052,798,000	42,323,000	4.02	431,830,000	2.32	9,854,000	2.28

[1] In counting the total number of producers reporting, a producer operating in more than 1 State, district, or county is counted but once.
[2] Includes carbon black made from liquid hydrocarbons.

Methods and yields.—The average yield of all carbon blacks continued to increase to 2.32 pounds per thousand cubic feet of gas burned in 1945 from 2.20 pounds in 1944. Significant gains were reported in Texas and Louisiana; declines in Oklahoma and the California-Kansas-New Mexico group were apparently caused by greater channel-black output in those areas.

The 1945 gain in furnace-black production (33 percent) was less rapid than in the other war years, suggesting the approach of a temporary peak in output of these grades. Semireinforcing (SRF) blacks constituted over 50 percent of the 1945 furnace-process blacks and high-modulus (HMF) blacks over 30 percent. Furnace plants consumed approximately 51,700 million cubic feet of natural gas and over 15 million gallons of liquid hydrocarbons in 1945.

The yield at contact-type plants increased from 1.32 pounds of black per thousand cubic feet of natural gas consumed in 1944 to 1.42 pounds in 1945. Data on production by principal grades in 1945 are not available, but the easy-processing grade in 1944 amounted to almost 80 percent of total contact-black production. The channel and other contact-type plants utilized 380,144 million cubic feet of natural gas in 1945.

Number and capacity of plants.—Of the six new channel-black plants that began to produce in 1945—all owned by the Defense Plant Corporation and operated by private companies—three are in Texas, two in New Mexico, and one in Oklahoma. One new furnace plant, owned by the Columbian Carbon Co., commenced operating at Seagraves, West Texas.

Two plants were shut down in 1944 and did not operate during 1945. They are the roller-type plant of the United Carbon Co., at Ryus, Kan., and the channel plant of Chas. E. Johnson & Co., at Bastrop, Morehouse Parish, La.

The total number of operating plants was thus increased from 54 in 1944 to 59 in 1945, of which 43 were contact-type plants and 16 furnace (including 1 "Thermatomic").

Plans for construction of two Government plants at McCoy, La., and Eunice, N. Mex., were abandoned in 1945. A third project, at South Eunice, N. Mex., for which only the engineering work had been done, was sold in July 1946 to a new company.

The total reported capacity of all plants that produced in 1945 was 3,633,600 pounds per day, an increase of 41 percent over 1944. The capacity of contact-type plants increased from 1,347,710 to 1,770,600 pounds daily (31 percent) and that of furnace plants from 1,237,706 to 1,863,000 pounds (51 percent). The ratio of production to total capacity at the year end was 79 percent in 1945 and 85 percent in 1944.

Producers.—The number of producing companies was reduced to 21 in 1945 from 22 in 1944 by elimination of the Crescent Carbon Co. whose channel plant at Borger, Tex. was acquired by the United Carbon Co. in June 1944.

DEMAND

Total deliveries.—Producers' total sales increased 9 percent over the 1944 record to 1,020,035,000 pounds, of which 83 percent were to domestic users and 17 percent to foreign countries. Exports accounted for 37 percent of total deliveries in the 1936–39 period and domestic sales for 63 percent. On September 30, 1945, the Government abandoned the wartime practice of purchasing carbon black from producers for resale to consumers, and distribution returned to normal trade channels.

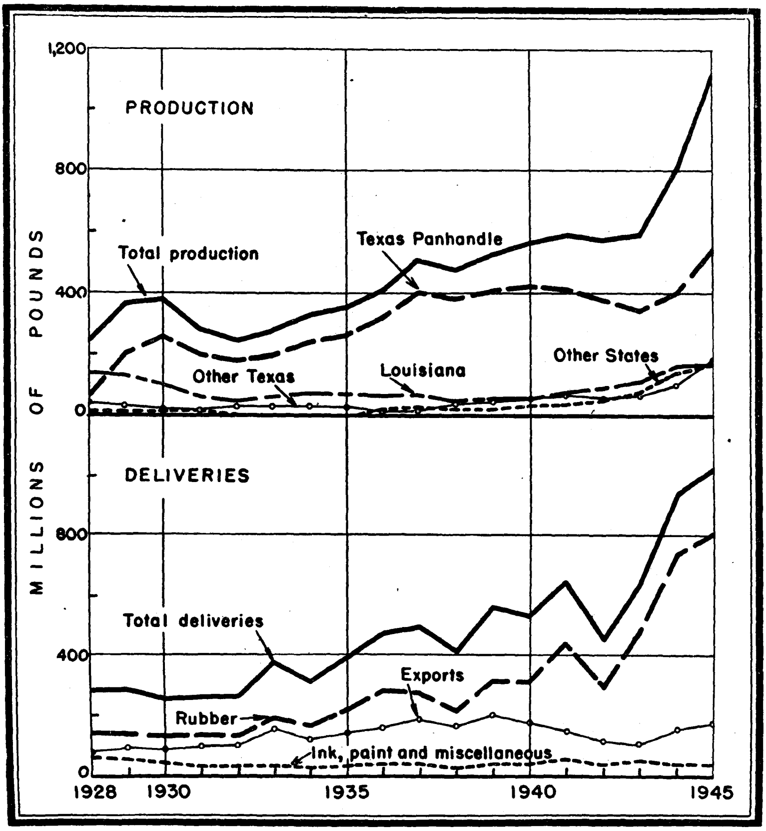

FIGURE 2.—Production and deliveries of carbon black 1928–45. Production in "Other Texas" includes Oklahoma and Wyoming in 1932–35.

Domestic demand.—Domestic deliveries amounted to 846,262,000 pounds in 1945—8 percent more than in 1944.

Sales of 804,386,000 pounds to rubber companies were 9 percent above 1944 and constituted 95 percent of all domestic deliveries. Demand for rubber grades of black in the third quarter of 1945 was below production but was at record levels at the end of the year.

Restraints upon the consumption of carbon black by the ink and paint trades were imposed by Government controls in the first half of the year and by scarcities of drying oils and resins needed in manufacture of inks and paints throughout 1945. Deliveries of 22,824,000 pounds to ink companies in 1945 were 7 percent below 1944. The apparent consumption of newsprint in the United States was 3,507,000 short tons in 1945 and 3,243,000 in 1944, according to the American Newspaper Publishers Association. Deliveries to paint manufacturers in 1945 increased 40 percent over 1944 to 7,421,000 pounds, stimulated by strong demand for high-color blacks late in the year, particularly for automotive enamels and lacquers.

Carbon-black producers of the United States, as of Dec. 31, 1945

State and company	County or parish	Nearest town	Process
California: Shell Chemical Division of Shell Union Oil Corp.	Contra Costa	Pittsburg	Furnace.
Kansas:			
Peerless Carbon Black Co	Grant	Ulysses	Contact.
United Carbon Co., Inc	do	Ryus	Furnace.
Louisiana:			
Cabot Carbon Co	Ville Platte	Ville Platte	Do.
Columbian Carbon Co	Avoyelles	Eola	Do.
Imperial Oil & Gas Products Co	Ouachita	Sterlington	Channel.
Southern Carbon Co	do	Hancock	Furnace.
Thermatomic Carbon Co	do	Sterlington	Thermatomic.
United Carbon Co., Inc	do	Swartz	Channel.
New Mexico:			
Columbian Carbon Co	Lea	Eunice	Do.
Charles Eneu Johnson & Co	do [1]	Hobbs	Do.
Panhandle Carbon Co	do [1]	do	Do.
Oklahoma:			
Cabot Carbon Co	Texas [1]	Guymon	Do.
	do	do	Furnace.
General Atlas Carbon Co	do	do	Do.
Charles Eneu Johnson & Co	Pontotoc	Stonewall	Channel.
Texas:			
Cabot Carbon Co	Carson	Skellytown	Do.
	Gray	Pampa	Do.
	Hutchinson	Stinnett	Do.
	Ward	Monahans	Do.
	Winkler	Kermit	Do.
Carbon Blacks, Inc	Gray	Lefors	Roller.
Coltexo Corporation	do	do	Channel.
Columbian Carbon Co	Carson [2]	(2)	(2)
	Gaines [1]	Seagraves	Channel.
	Gray	Kings Mill	Do.
	do	Lefors	Do.
	Harris	Fortune	Furnace.
	Hutchinson	Borger (2 plants[2 3])	Channel.
	Montgomery	Conroe	Furnace.
	Moore	Sunray	Channel.
	Nueces	Corpus Christi	Do.
	Terry	Seagraves	Furnace.
Columbian-Phillips Co	Moore	Sunray	Channel.
Combined Carbon Co	Hutchinson	Sanford	Do.
Continental Carbon Co	Moore	Sunray (2 plants)	Do.
	do	do	Furnace.
Crown Carbon Co	do	do	Channel.
General Atlas Carbon Co	Gray	Pampa	Furnace.
J. M. Huber Corporation	Hutchinson	Borger	Do.
	do	do	Channel.
Moore County Carbon Co	Moore	Sunray	Do.
Panhandle Carbon Co	Hutchinson	Borger	Do.
Peerless Carbon Black Co	Gray	Pampa	Contact.
Phillips Petroleum Co	Hutchinson	Borger	Furnace.
Texas Elf Carbon Co	Gray	Pampa	Channel.
	Stephens	Eliasville	Do.
United Carbon Co., Inc	Aransas	Aransas Pass	Do.
	do	do	Furnace.
	Ector [1]	Odessa	Channel.
	Hutchinson	Borger (4 plants)	Do.
	do	Sanford (2 plants)	Do.
	do	Stinnett	Do.
	Moore	Sunray	Do.

[1] Owned by the Defense Plant Corporation.
[2] Plant, located in both Carson and Hutchinson Counties, counted in Hutchinson County.
[3] 1 owned by the Defense Plant Corporation.

The supply of blacks to miscellaneous users declined 8 percent below 1944 to 11,631,000 pounds and was less than half the 1943 volume.

Carbon black exported from the United States, 1944–45, by months and customs districts

Month	1944		1945	
	Pounds	Value	Pounds	Value
January	6, 560, 872	$283, 084	14, 881, 600	$714, 604
February	11, 556, 588	527, 433	8, 646, 100	399, 826
March	19, 577, 296	923, 801	15, 556, 459	798, 195
April	14, 407, 766	666, 071	10, 201, 823	520, 884
May	13, 058, 505	631, 322	13, 308, 061	734, 889
June	13, 789, 352	674, 756	12, 014, 691	661, 363
July	13, 774, 533	652, 232	12, 254, 969	696, 114
August	10, 925, 485	548, 655	14, 243, 030	826, 223
September	8, 074, 561	391, 382	14, 715, 600	902, 545
October	16, 947, 619	816, 108	20, 377, 095	1, 272, 413
November	13, 111, 199	623, 796	19, 169, 083	1, 148, 361
December	15, 206, 744	718, 729	18, 404, 107	1, 155, 436
	156, 990, 520	7, 457, 369	173, 772, 618	9, 830, 853

Customs district	1944		1945	
	Pounds	Value	Pounds	Value
Buffalo	979, 289	$43,260	418, 209	$24, 566
El Paso	1, 183, 575	47, 794	1, 084, 125	53, 981
Galveston	59, 247, 664	2, 934, 185	74, 068, 697	4, 484, 931
Georgia	18, 873, 307	910, 373	18, 114, 100	1, 025, 513
Laredo	2, 131, 357	92, 278	3, 640, 774	178, 966
Los Angeles	836, 100	52, 445		
Michigan	37, 687, 852	1, 447, 949	44, 129, 131	1, 966, 117
New Orleans	16, 891, 130	871, 902	22, 155, 014	1, 448, 970
New York	8, 477, 459	482, 490	1, 709, 310	135, 559
Philadelphia	1, 796, 520	105, 051	1, 319, 513	81, 464
San Francisco	3, 406, 058	200, 922	6, 177, 005	362, 471
Other districts	5, 480, 209	268, 720	956, 740	68, 315
	156, 990, 520	7, 457, 369	173, 772, 618	9, 830, 853

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Exports and imports.[1]—The rise in exports that began in 1944, continued in 1945 with particularly large movements in the last quarter. The total of 173,772,618 pounds shipped in 1945 compared with 156,990,520 pounds in 1944 and approximated the prewar annual rate.

Exports to Belgium and France were resumed after liberation of those countries, and larger shipments were made to most importing countries. The only notable declines were in shipments to India and the U. S. S. R., countries that imported unusually large amounts of carbon black from the United States during the war.

Carbon black exported in 1945 was valued at an average of 5.66 cents per pound compared with 4.75 cents in 1944.

Imports of "gas black and carbon black" from Canada gained sharply in 1945 to 1,526,758 pounds, with an average value of 9.7 cents a pound, compared with 267,158 pounds in 1944, valued at 9.8 cents. Imports of acetylene black from Canada declined to 7,583,370 pounds with an average value of 9.76 cents a pound in 1945 from 8,574,693 pounds valued at 9.81 cents a pound in 1944.

Carbon black exported from the United States, 1943–45, by countries

Country	1943		1944		1945	
	Pounds	Value	Pounds	Value	Pounds	Value
Argentina	617,341	$37,656	568,735	$36,523	2,382,148	$171,618
Australia	3,738,075	172,963	6,393,433	360,755	15,407,249	982,087
Belgium and Luxembourg					3,018,925	202,515
Brazil	6,599,200	321,455	4,067,702	214,220	5,319,529	334,799
Canada	27,667,557	1,044,229	39,059,668	1,510,720	45,103,317	2,019,005
Chile	141,425	7,776	239,738	13,613	475,800	30,624
Colombia	736,598	33,939	151,916	9,510	717,668	45,252
Cuba	366,890	21,612	1,088,675	58,626	880,985	57,143
Egypt	193,250	10,864	30,450	2,507	48,600	3,523
France					3,837,000	243,973
Guatemala	35,004	1,728	17,225	1,135	14,575	1,274
India and dependencies	9,071,851	427,322	12,114,361	630,535	5,606,928	351,029
Mexico	3,251,683	143,162	3,329,528	141,342	4,835,794	240,050
New Zealand	227,050	11,293	894,067	49,176	722,455	41,523
Peru	320,426	16,081	242,434	12,410	456,435	29,629
Portugal	68,741	4,266	51,257	3,058	520,913	32,374
Spain	1,373,050	77,414	947,750	50,949	1,051,630	62,350
Sweden	69,900	5,088	1,455,408	63,499	1,793,935	120,469
Union of South Africa	4,547,319	220,292	9,413,576	464,453	8,335,514	539,659
U. S. S. R.	57,100	8,256	4,204,458	256,170	803,445	48,440
United Kingdom	45,109,474	2,213,845	71,333,550	3,492,115	69,549,113	4,039,658
Other countries	719,838	45,022	1,386,589	86,053	2,890,660	233,859
	104,911,772	4,824,263	156,990,520	7,457,369	173,772,618	9,830,853

STOCKS

Producers' stocks of contact blacks began the year at 58,036,000 pounds, were depleted rapidly to about 22 million pounds in April, then were gradually built up to 64,956,000 pounds on December 31, 1945. Furnace-black inventories varied similarly. Beginning at 11,207,000 pounds, the pressure of urgent demand kept them very low until July, after which an easier supply-demand position permitted accumulation to 37,049,000 pounds at the year end.

[1] Figures on exports and imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

PRICES AND VALUES

Liberalization of price-ceiling regulations during 1945 contributed to the rise in average value of carbon black at the plants from 3.67 cents a pound in 1944 to 4.02 cents in 1945. The average value of contact process blacks was 3.50 and 4.11 cents a pound in 1944 and 1945, respectively, and comparable furnace black values were 3.84 and 3.93 cents.

In March the Office of Price Administration permitted an increase in ceiling prices on all rubber grades of channel black produced under emergency high-cost conditions from 3.3 cents a pound in bulk for uncompressed beads to 5.0 cents a pound and 5.5 cents for compressed beads. This action was taken to stimulate production.

With the return of carbon-black marketing to normal trade channels on September 30 (purchases by Defense Supplies Corporation were discontinued), price ceilings for blacks from low-cost producing facilities were adjusted to conform to the higher-cost ceilings, resulting in uniform ceilings for each grade of channel black. Ceiling prices on channel black for use in paint and inks were raised 1.7 cents a pound in October to compensate for higher costs of natural gas.

ASPHALT AND RELATED BITUMENS

By A. H. Redfield[1]

SUMMARY OUTLINE

SUMMARY

Domestic demand for petroleum asphalt was 1 percent higher, and export demand 79 percent higher in 1945 than in 1944. Export demand, however, was only 3 percent of the total demand, domestic and foreign, so that the total demand increased 2 percent in 1945 over 1944. To meet the greater demand, domestic and foreign, petroleum refineries in the United States enlarged their output 2 percent from 1944 to 1945; and more petroleum asphalt was imported. Stocks, however, were 11 percent higher at the end of 1945 than at the beginning of the year. In numerical terms, an increase of 54,590 short tons in domestic demand and of 93,746 tons in foreign demand, as well as a rise of 66,500 in inventories during 1945, were made possible by increases of 130,500 tons in refinery production and of 17,436 tons in imports and by the addition during 1944 of 66,900 tons to inventories.

Bituminous rock did not share in the continued demand which maintained sales of paving asphalt at their 1944 level; its sales were 13 percent less in 1945 than in 1944. On the other hand, sales of gilsonite were 25 percent more in 1945 than in 1944. Exports of natural asphalt, unmanufactured, increased 27 percent in 1945 over 1944.

NATIVE ASPHALT AND BITUMENS

Bituminous rock.—Although highway construction and maintenance were apparently more active in 1945 than in 1944, sales of bituminous rock by producers in the United States decreased from 740,454 short tons valued at $2,771,925 in 1944 to 642,600 tons valued at $2,565,925 in 1945. The decline was greater west of the Mississippi River. Sales by producers in Texas and Oklahoma decreased from 479,745 tons valued at $1,214,329 in 1944 to 413,021 tons valued at $1,054,380 in 1945. Smaller sales were made in California in 1945 than in 1944, but larger sales in Missouri and Utah—all three small producers. In Kentucky and Alabama, however, the decrease was less—from 226,190

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

tons valued at $1,315,234 in 1944 to 192,381 tons valued at $1,235,928 in 1945.

Gilsonite and wurtzilite.—Sales of gilsonite by producers in northeastern Utah increased materially—from 49,051 short tons valued at $918,480 in 1944 to 61,273 tons valued at $1,250,546 in 1945. The average sales price per ton at the mine or railhead increased from $18.73 in 1944 to $20.41 in 1945.

No wurtzilite was sold in 1945. Sales of wurtzilite in 1944 amounted to 11 tons valued at $874.

Exports.—The tonnage of natural asphalt, unmanufactured, exported from the United States increased from 37,210 short tons valued at $729,765 in 1944 to 47,094 tons valued at $1,207,147 in 1945. In spite of a decrease in shipments to Australia and New Zealand (the principal area of foreign demand) and to South America, enlarged exports to Europe, as well as smaller increases in exports to India and to Canada, raised the total exports of natural asphalt 26 percent over the corresponding exports of 1944. Of the 1945 exports 44 percent went to Australia and New Zealand, 35 percent to Europe, principally to Norway, Sweden, France, and the United Kingdom, 14 percent to India, and 3 percent to Canada and Mexico.

MANUFACTURED OR PETROLEUM ASPHALT

Production.—Production of asphalt by petroleum refineries in the United States increased 2 percent from 1944 to 1945. The principal gains in tonnage were in the East Coast district, where 15 percent more asphalt was made in 1945 than in 1944. East of the Mississippi River and in interior United States the production of asphalt gained,

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of asphalt (exclusive of road oil) at petroleum refineries in the United States in 1945, by districts, in short tons

District	Production	Receipts from other sources	Stocks		Consumption by companies, transfers, losses, and exports	Sales to domestic consumers
			Dec. 31, 1944	Dec. 31, 1945		
East Coast	1,602,200	253,500	100,200	125,300	187,000	1,643,600
Appalachian	315,000	27,000	33,400	35,300	11,600	328,500
Indiana, Illinois, Kentucky, etc	1,450,700	109,200	115,100	140,500	246,600	1,287,900
Oklahoma, Kansas, and Missouri	671,500	119,600	96,900	79,100	77,900	731,000
Texas:						
Gulf Coast	314,700		20,900	24,700	92,300	218,600
Inland	315,200	7,000	21,100	37,100	66,200	240,000
Total Texas	629,900	7,000	42,000	61,800	158,500	458,600
Louisiana-Arkansas:						
Louisiana Gulf Coast	409,000		51,100	53,100	50,100	356,900
Arkansas and Louisiana Inland	403,000	57,200	42,900	43,400	49,900	409,800
Total Louisiana-Arkansas	812,000	57,200	94,000	96,500	100,000	766,700
Rocky Mountain	289,900	65,200	40,600	46,700	79,000	270,000
California	1,355,400	12,800	104,000	107,500		1,364,700
Total United States:						
1945	7,126,600	651,500	626,200	692,700	860,600	6,851,000
1944	6,996,100	302,500	563,300	626,200	500,500	6,735,200

except in the Appalachian district. On the Gulf coast, increased output of asphalt in coastal Louisiana more than offset a decline in coastal Texas. In the Rocky Mountain district, however, asphalt production decreased 9 percent from 1944 to 1945; and in California it decreased 11 percent.

Stocks.—Stocks of petroleum asphalt held at refineries were 11 percent higher on December 31, 1945, than on December 31, 1944. The most marked increase in tonnage of inventories during 1945 occurred in the Indiana, Illinois, Kentucky, etc., district, closely followed by the East Coast district. Asphalt stocks in the Texas Inland district were considerably larger at the end of 1945 than 1 year previously. Except in the Oklahoma-Kansas-Missouri district, increases in asphalt inventories were general over the United States during 1945.

Sales.—Sales of petroleum asphalt to domestic consumers increased 2 percent in quantity and 4 percent in value from 1944 to 1945. The average value at the refinery increased from $11.24 in 1944 to $11.51 in 1945.

Of the total sold, 15.8 percent was manufactured from foreign petroleum (imported chiefly from Venezuela, Colombia, and Mexico) in 1945 compared with 10.6 percent in 1944. Although runs of foreign crude to stills increased 71 percent from 1944 to 1945, sales of petroleum asphalt from this source increased only 52 percent. Of the foreign crude processed, 9 percent was converted into asphalt in 1944 and 8 percent in 1945. East Coast refineries sold 99 percent of the total asphalt made from foreign crude in 1944 and all of that sold in 1945.

Sales of asphalt (exclusive of road oil) at petroleum refineries to domestic consumers in the United States, 1944–45, by districts

District	1944		1945	
	Short tons	Value	Short tons	Value
East Coast	1, 396, 399	$19, 134, 342	1, 643, 569	$22, 621, 332
Appalachian	335, 013	4, 862, 072	328, 547	4, 663, 038
Indiana, Illinois, Kentucky, etc	1, 298, 727	16, 064, 817	1, 287, 862	15, 490, 678
Oklahoma, Kansas, and Missouri	608, 190	5, 269, 350	731, 012	6, 645, 035
Texas:				
Gulf Coast	289, 694	2, 884, 935	218, 593	2, 259, 179
Inland	287, 396	3, 172, 139	239, 915	2, 399, 721
Total Texas	577, 090	6, 057, 074	458, 508	4, 658, 900
Louisiana-Arkansas:				
Louisiana Gulf Coast	283, 923	3, 147, 050	356, 889	3, 826, 407
Arkansas and Louisiana Inland	345, 706	2, 923, 456	409, 842	3, 122, 176
Total Louisiana-Arkansas	629, 629	6, 070, 506	766, 731	6, 948, 583
Rocky Mountain	376, 855	3, 027, 864	270, 029	2, 505, 799
California	1, 513, 273	15, 228, 639	1, 364, 726	15, 342, 189
Total United States	6, 735, 176	75, 714, 664	6, 850, 984	78, 875, 554

Highway and street construction and airport-runway surfacing (in the form of paving asphalt, paving flux, cut-back asphalts, and asphalt emulsions) used 67 percent of the total asphalt sold to domestic consumers by petroleum refineries in 1944 and 64 percent in 1945. Street and road contracts exceeding $25,000, according to Engineering

Asphalt and asphaltic material (exclusive of road oil) sold at petroleum refineries to domestic consumers in the United States in 1945, by varieties

[Value f. o. b. refinery]

Variety	From domestic petroleum		From foreign petroleum		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Solid and semisolid products of less than 200 penetration:						
Asphalt for—						
Paving	1,565,092	$18,255,481	338,910	$4,595,255	1,904,002	$22,850,736
Roofing	907,903	11,408,782	392,347	5,213,473	1,300,250	16,622,255
Waterproofing	73,325	1,099,343	27,924	394,659	101,249	1,494,002
Blending with rubber	9,971	158,080	9,512	135,083	19,483	293,163
Briquetting	154,538	1,493,256	357	4,964	154,895	1,498,220
Mastic and mastic cake	10,811	171,890	23,293	314,176	34,104	486,066
Pipe coatings	17,783	266,624	172	2,404	17,955	269,028
Molding compounds	44,804	589,015	14	206	44,818	589,221
Miscellaneous uses	163,633	2,275,437	12,343	149,024	175,976	2,424,461
	2,947,860	35,717,908	804,872	10,809,244	3,752,732	46,527,152
Semisolid and liquid products of more than 200 penetration:						
Flux for—						
Paving	212,836	1,620,324	12,248	162,344	225,084	1,782,668
Roofing	734,012	5,917,901	15,342	201,495	749,354	6,119,396
Waterproofing	7,834	75,574			7,834	75,574
Mastic	50,048	498,654			50,048	498,654
Cut-back asphalts:						
Rapid-curing	546,404	6,401,957	146,383	2,131,033	692,787	8,532,990
Medium-curing	1,086,855	12,003,616	82,131	1,080,086	1,168,986	13,083,702
Emulsified asphalts and fluxes	68,967	697,268	976	14,502	69,943	711,770
Paints, enamels, japans, and lacquers	31,422	475,796	14,767	197,083	46,189	672,879
Other liquid products	83,985	806,508	4,042	64,258	88,027	870,766
	2,822,363	28,497,598	275,889	3,850,801	3,098,252	32,348,399
Total: 1945	5,770,223	64,215,506	1,080,761	14,660,045	6,850,984	78,875,551
1944	6,022,954	66,109,282	712,222	9,605,382	6,735,176	75,714,664

News-Record, showed an increase of 16 percent in value—from 195.7 million dollars in 1944 to 227.3 million dollars in 1945—and of 12.7 percent in indicated volume if the values are adjusted by the Engineering News-Record index of construction costs. The increases were greatest in the 14 States west of the Mississippi River and east of the Rocky Mountain front and in the 5 Middle Atlantic States lying north of the Potomac River. Smaller increases occurred in the 10 Southeastern States lying east of the Mississippi River and south of the Ohio and Potomac Rivers, as well as in Louisiana and the District of Columbia; and in the 6 New England States. On the other hand, the recorded contracts indicated decreased road and street construction in the 7 Pacific and Rocky Mountain States and in the 5 States east of the Mississippi between the Ohio River and the Great Lakes.

Although the available statistics indicate greater activity in highway construction and maintenance in 1945 than in 1944, sales of paving asphalt used for high-type surfacing increased less than 1 percent—from 1,889,966 short tons in 1944 to 1,904,002 tons in 1945. Sales of cut-back asphalts suitable for surfacing lighter-type highways were 9 percent lower in 1945 than in 1944. The popularity of medium-curing cut-backs suffered a set-back; 14 percent less of this type of cut-back was sold in 1945 than in 1944, but sales of rapid-curing cut-backs increased slightly.

The quantity of emulsified asphalt sold in 1945 was less than in 1944, but the value was higher. Petroleum refineries sold 97,389 short tons (22,946,747 gallons) valued at $1,113,781 in 1944 and 69,943 tons (16,479,935 gallons) valued at $711,770 in 1945. In addition, 65,726,027 gallons valued at $5,970,053 in 1944 and 68,747,092 gallons valued at $6,493,043 in 1945 were sold by major industrial companies that purchased asphalt from petroleum refineries and manufactured it into emulsions. Accordingly, total known sales of emulsified asphalts and fluxes decreased 3.9 percent in quantity—from 88,672,774 gallons in 1944 to 85,227,027 gallons in 1945—but increased 1.8 percent in value—from $7,083,834 in 1944 to $7,204,813 in 1945.

Roofing manufacture made the second-largest demand for asphalt, absorbing 26 percent of the total sales to domestic consumers in 1944 and 30 percent in 1945. Although shipments of prepared roofing reported to the Bureau of the Census increased only 1 percent—from 48,691,000 squares in 1944 to 49,156,000 squares in 1945—domestic sales of roofing asphalt and roofing flux combined increased 16 percent—from 1,763,552 short tons in 1944 to 2,049,685 in 1945. These figures do not include roofing asphalt and flux consumed by the companies in factories of prepared roofing owned by themselves or by affiliated companies.

DOMESTIC DEMAND

The indicated average monthly domestic demand for petroleum asphalt (including small quantities of imported lake asphalt and grahamite) increased less than 1 percent—from 578,708 short tons in 1944 to 583,258 tons in 1945.

The period of high demand that had characterized 1940–44 continued into 1945. In terms of the long-term trend, the indicated demand was 41 percent above the expected demand for 1944 and 38 percent above that for 1945; that is, if the national demand had continued the average growth it manifested from 1908 to 1944, it would have averaged 412,072 tons a month in 1944 and 423,173 tons in 1945. If these averages are used as a standard of comparison the indicated demand of 578,708 tons a month in 1944 was 141 percent of the expected demand (412,072 tons) in 1944, and the indicated demand of 583,258 tons a month in 1945 was 138 percent of the expected demand (423,193 tons).

On a monthly basis, demand was slightly higher during the first 3 months of both 1944 and 1945 than the normal seasonal trend would warrant. From January to March 1944 demand amounted to 15 percent of the annual total and during the corresponding months of 1945 to 15.6 percent of the total, compared to a statistical "normal" of 13.9 percent. On the other hand, during the 6 months from May 1 to October 30, 1944, 66.5 percent of the total demand for the year occurred and during the corresponding months of 1945, 65.3 percent of the annual demand, compared with a statistical "normal" of 67 percent during those 6 months.

Relation of indicated asphalt demand to basic trend, multiplied by seasonal factors, 1944–45, by months

Months	1944			1945		
	Indicated monthly demand	Trend, multiplied by seasonal factors	Relation of indicated monthly demand to trend	Indicated monthly demand	Trend, multiplied by seasonal factors	Relation of indicated monthly demand to trend
January	357,600	212,500	168.3	356,600	218,300	163.3
February	300,500	208,700	144.0	335,400	214,300	156.5
March	386,100	267,200	144.5	399,400	261,700	152.6
April	397,100	331,900	119.6	483,600	340,900	141.8
May	571,500	443,700	128.8	622,500	455,700	136.6
June	737,100	533,500	138.2	768,100	547,900	140.1
July	825,000	596,200	138.4	891,400	613,500	145.2
August	938,700	622,100	150.9	903,000	638,900	141.3
September	844,100	590,000	143.1	732,200	605,900	120.8
October	704,100	529,700	132.9	655,600	544,000	120.5
November	478,400	358,600	133.4	516,400	368,200	140.2
December	404,300	249,500	162.0	334,900	256,300	130.6
	6,944,500	4,943,600	140.5	6,999,100	5,065,600	138.1

DISTRIBUTION BY RAIL

The tonnage of asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States increased from 5,145,677 short tons in 1944 to 5,379,418 tons in 1945, according to freight-commodity statistics compiled by the Interstate Commerce Commission. Of the total deliveries during the 2 years, 56 percent was set down in the populous area north of the Potomac and Ohio Rivers and east of the Mississippi River, although this area comprised only 14 percent of the area of continental United States. Increased deliveries in central and southern United States more than offset decreases in New England, the Middle Atlantic States, the Rocky Mountain States, and the Pacific States.

Asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States, 1944–45, by States, in short tons

State and group	1944	1945
New England	125,742	113,078
Middle Atlantic:		
New York	159,852	178,777
New Jersey	63,376	82,980
Pennsylvania	496,796	421,796
	720,024	683,553
East North Central:		
Ohio	1,031,168	1,173,229
Indiana	233,980	210,466
Illinois	353,903	379,018
Michigan	146,704	154,270
Wisconsin	171,163	181,356
	1,936,918	2,098,339
West North Central:		
Minnesota	83,543	93,503
Iowa	53,319	54,944
Missouri	83,721	99,385
North Dakota	19,622	26,083
South Dakota	21,030	27,850
Nebraska	45,434	43,764
Kansas	40,688	50,608
	347,357	396,137

Asphalt (natural, byproduct, or petroleum) terminated by class I railroads in the United States, 1944–45, by States, in short tons—Continued

State and group	1944	1945
South Atlantic:		
Delaware	30,668	23,893
Maryland	50,567	72,934
District of Columbia	1,464	989
Virginia	164,822	187,691
West Virginia	91,515	77,996
North Carolina	63,671	63,188
South Carolina	45,391	50,411
Georgia	52,223	55,772
Florida	97,931	81,102
	598,252	613,976
East South Central:		
Kentucky	61,348	84,991
Tennessee	54,925	76,613
Alabama	52,032	92,847
Mississippi	59,128	47,594
	227,433	302,045
West South Central:		
Arkansas	37,495	37,596
Louisiana	98,662	175,479
Oklahoma	27,115	31,356
Texas	148,335	183,983
	311,607	428,414
Mountain:		
Montana	9,400	14,172
Idaho	17,470	15,566
Wyoming	12,463	36,677
Colorado	50,193	58,245
New Mexico	43,521	42,937
Arizona	58,841	26,716
Utah	34,270	22,987
Nevada	25,933	13,717
	252,091	231,017
Pacific:		
Washington	132,709	73,442
Oregon	61,009	56,882
California	432,535	382,535
	626,253	512,859
Total United States	5,145,677	5,379,418
Canada	2,606	5,216
	5,148,283	5,384,634

Source: Interstate Commerce Commission, Freight Commodity Statistics.

FOREIGN TRADE

Imports.—Imports of natural asphalt and bitumen into the United States in 1945 totaled 5,148 short tons valued at $122,207, compared with 8,235 tons valued at $254,135 in 1944. Imports of lake asphalt from Trinidad decreased from 8,062 short tons valued at $249,866 in 1944 to 4,926 tons valued at $116,219 in 1945; and imports of grahamite from Cuba decreased from 999 short tons valued at $17,900 to 222 tons valued at $5,927.

Imports of solid petroleum asphalt increased from 123,938 short tons valued at $705,133 in 1944 to 142,802 tons valued at $798,667 in 1945. Of the 1944 and 1945 imports, virtually all came from the Netherlands West Indies.

In addition, 13,033 barrels (2,370 tons) of liquid petroleum asphalt valued at $20,801 were imported in 1944 and 22,161 barrels (4,029 tons) valued at $43,028 in 1945. The Netherlands West Indies supplied virtually all the liquid petroleum asphalt imported into the United States in 1944 and 1945.

Petroleum asphalt exported from the United States, 1943–45, by countries

Country	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Canada	3,604	$195,992	4,225	$238,827	4,223	$215,131
Cuba	80	1,832	228	7,526	299	7,600
Guatemala	728	17,204	213	3,499	93	1,368
Mexico	3,891	74,698	2,989	47,068	1,274	21,588
Newfoundland and Labrador	4,109	86,070	2,008	29,081	2,242	45,566
Nicaragua	1,158	23,258	616	13,090	624	14,396
Panama:						
Canal Zone	8,956	201,406	1,695	46,968	115	3,175
Republic of	51	1,626	316	5,225	429	9,836
Other North America	5,283	107,772	1,467	26,677	2,999	68,503
	27,860	709,858	13,757	417,961	12,298	387,163
South America:						
Argentina	3	120	13	807	36	1,284
Bolivia	346	4,035	1,304	22,929	1,524	42,957
Brazil	1,116	33,965	10,514	208,907	7,050	145,539
Chile	3,577	69,831	2,146	45,555	5,780	137,875
Uruguay	762	14,023	1,402	24,676	2,643	57,556
Venezuela	133	5,786	139	3,785	246	6,518
Other South America	88	4,943	998	26,600	272	8,530
	6,025	132,703	16,516	333,259	17,551	400,259
Europe:						
France					8,813	215,378
Norway					4,592	118,806
Portugal			1,524	28,228	4,313	103,797
Spain	8	326			20,241	559,830
Sweden			527	15,531	26,870	753,259
Other Europe					3,550	97,738
	8	326	2,051	43,759	68,379	1,848,808
Asia:						
China					1,894	45,093
India and Dependencies	5,120	121,920	17,348	405,267	48,755	1,142,680
Philippine Islands					393	10,403
Other Asia	68	3,284	55	2,193	463	10,225
	5,188	125,204	17,403	407,460	51,505	1,208,401
Africa:						
Belgian Congo	74	1,980	57	1,390	236	7,352
British East Africa	59	4,092	25	1,819	48	1,908
French West Africa					2,211	69,875
Mozambique			2	184	2,594	48,121
Nigeria	2,741	91,165			1,216	33,697
Union of South Africa	683	29,056	3,286	60,942	13,100	228,266
Other Africa	1,605	53,208	1,605	53,288	827	20,170
	5,162	179,501	4,975	117,623	20,232	409,389
Oceania:						
Australia	29,517	717,482	57,724	1,128,337	41,179	876,866
New Zealand	12,311	282,329	6,786	157,214	1,695	38,246
Other Oceania					119	2,637
	41,828	999,811	64,510	1,285,551	42,993	917,749
	86,071	2,147,403	119,212	2,605,613	212,958	5,171,769

Exports.—Exports of petroleum asphalt from the United States in 1945 were 79 percent larger than in 1944 and approximated the prewar average. The most marked increase was in shipments to Europe, especially to Sweden and to Spain; to Asia, notably to British India; and to Africa, chiefly the Union of South Africa. Asphalt exports to South America increased slightly. On the other hand, exports to Australia and New Zealand decreased considerably, and shipments to other North American countries were generally less in 1945 than in 1944.

ROAD OIL

Reported sales of road oil by refineries in the United States increased 26 percent in quantity—from 2,031,000 barrels in 1944 to 2,567,000 barrels in 1945—but decreased 6 percent in value—from $3,783,000 in 1944 to $3,561,000 in 1945. What was sold in 1944 and for nearly 9 months of 1945 as road oil might better have been described as liquid asphalt, as the use of petroleum residues having a penetration greater than 350 after distillation to 680° for highway purposes was officially forbidden until August 22, 1945.

Production, receipts, stocks, consumption, transfers, losses, exports, and domestic sales of road oil in the United States in 1945, by districts, in thousands of barrels

District	Production	Receipts from other sources	Stocks		Consumption by companies, transfers, losses, and exports	Sales to domestic consumers
			Dec. 31, 1944	Dec. 31, 1945		
East Coast	289	8	19	17	283	16
Indiana, Illinois, Kentucky, etc	539	37	2	17	201	360
Oklahoma, Kansas, and Missouri	298	72	5	6	11	358
Texas	26	660	4	5	3	682
Louisiana-Arkansas	38	12	2	6	34	12
Rocky Mountain	821	250	74	102	427	616
California	675	35	83	217	53	523
Total: 1945	2,686	1,074	189	370	1,012	2,567
1944	1,556	1,104	193	189	633	2,031

Road oil sold by petroleum refineries to domestic consumers in the United States, 1944–45, by districts

District	1944		1945	
	Thousands of barrels	Thousands of dollars	Thousands of barrels	Thousands of dollars
East Coast	78	214	16	36
Indiana, Illinois, Kentucky, etc	3	6	360	595
Oklahoma, Kansas, and Missouri	40	78	358	450
Texas	948	1,553	682	878
Louisiana-Arkansas	4	7	12	20
Rocky Mountain	157	245	616	876
California	801	1,680	523	706
Total United States	2,031	3,783	2,567	3,561

In 1944 three refining districts—Texas, California, and Rocky Mountain—together supplied 94 percent of the road oil sold in the United States in 1944. In 1945, however, production and sales of road oil had extended to central United States; Indiana, Illinois, Kentucky, etc., and Oklahoma, Kansas, Missouri, together sold 28 percent of the total and Texas, California, and Rocky Mountain 56 percent.

CEMENT

By Oliver Bowles and Esther V. Balser

SUMMARY OUTLINE

SUMMARY

The cement industry experienced a substantial recovery in 1945. The total production of 104,288,647 barrels of hydraulic cements was 13 percent higher than in 1944; but, with the exception of that year, it was lower than in any year since 1935. The gains were shared by portland cement and by the subsidiary group of natural, masonry, and puzzolan cements. The portland-cement industry operated at 43 percent and the "All other" group at 46 percent of productive capacity in 1945. Mill shipments of portland cement, which totaled 106,353,595 barrels, were 13 percent greater than in 1944. Shipments of the "All other" group gained 12 percent. Stocks of all hydraulic cements at mills on December 31, 1945, were 16,575,139 barrels, 18 percent less than at the close of 1944.

The average net mill realization per barrel of portland cement increased 4 cents from the 1944 price, reaching $1.63 per barrel. "All other hydraulic cements," as a group, gained 18 cents a barrel to $1.42.

The decline in the long-term trend of finished cement, which had continued since February 1943, was halted early in 1945, and in April it began an upward movement at a gradually accelerating rate.

Monthly production of cement diverged considerably from the usual peacetime seasonal pattern. The decline in January and February was less than normal, and from March to October the gains were more gradual and uniform than in prewar years. The decline in output during the last 3 months of the year, which is usually quite pronounced, was decidedly moderate in 1945, reflecting the growing demand of the construction industries for cement following the suspension of hostilities. As in 1944, peak production was attained in October.

The following table presents the principal statistics of the cement industry over a 5-year period.

Salient statistics of the cement industry in the United States, 1941–45

	1941	1942	1943	1944	1945 [1]
Production of finished cement:					
Portland ... barrels	164,030,559	182,781,184	133,423,788	90,905,696	102,804,884
Masonry, natural, and puzzolan (slag-lime) ... barrels	2,875,962	2,560,425	1,830,266	1,246,703	1,483,763
Total production ... do	166,960,521	185,341,609	135,254,054	92,152,399	104,288,647
Capacity used at portland-cement mills ... percent	66.3	73.5	55.0	37.8	42.5
Production of portland-cement clinker [2] ... barrels	163,628,857	181,267,461	135,692,400	90,508,803	102,702,976
Active plants:					
Portland	155	155	153	151	145
Masonry, natural, and puzzolan (slag-lime)	12	11	10	9	9
Shipment from mills:					
Portland ... barrels	167,439,237	185,300,884	127,631,859	94,271,881	106,353,595
Value [3]	$246,621,914	$283,237,028	$200,103,216	$150,357,754	$173,337,010
Per barrel	$1.47	$1.53	$1.57	$1.59	$1.63
Masonry, natural, and puzzolan (slag-lime) ... barrels	2,926,023	2,508,324	1,846,803	1,320,274	1,479,513
Value [3]	$3,967,567	$3,668,169	$2,357,112	$1,638,892	$2,093,848
Per barrel	$1.36	$1.46	$1.28	$1.24	$1.42
Total shipments ... barrels	170,365,440	187,809,208	129,478,662	95,592,155	107,833,108
Value	$250,589,481	$286,905,197	$202,460,328	$151,996,646	$175,430,858
Stocks at mills, Dec. 31:					
Portland:					
Finished cement ... barrels	19,964,918	17,380,273	23,188,975	[4] 19,952,711	[5] 16,404,000
Clinker [2] ... do	4,574,528	3,509,336	5,959,170	[4] 5,328,986	[5] 4,460,092
Masonry, natural, and puzzolan (slag-lime) ... barrels	199,365	253,307	236,770	[4] 166,889	[5] 171,139
Imports ... do	43,466	644	13,658	169	323
Exports ... do	2,556,234	1,100,826	1,731,956	4,040,405	6,476,333
Apparent consumption ... do	167,852,672	186,709,026	127,760,364	91,551,919	101,357,098

[1] Includes new mill in Hawaii, completed late in 1944.
[2] Compiled from monthly reports by producers.
[3] Value received f. o. b. mill, excluding cost of containers.
[4] Revised figures.
[5] Subject to revision.

Shipments from mills, which were less than 5 million barrels per month in January and February, increased rapidly to a maximum of 13,303,000 barrels in October. A sharp seasonal decline characterized November and particularly December.

In 1945, as in 1944, the Middle States comprised the leading cement-consuming region in continental United States. (See fig. 1.) States in the regions shown in figure 1 are as follows: Northeastern—Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Southern—Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; Middle—Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; Rocky Mountain—Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming; Pacific—California, Oregon, and Washington.

A marked gain in output and mill shipments of cement in 1945 was to be expected in view of the increase of approximately 20 percent in total new construction compared with 1944, as determined by the United States Department of Commerce. The gain in building construction was partly offset by the continued decline in area of new concrete pavements, which dropped from a monthly average of 2,723 thousand square yards in 1944 to 1,751 thousand in 1945.

Maximum Price Regulation Order 224 of the Office of Price Administration was amended three times during 1944 to allow price increases in several areas. Five additional amendments were promulgated in 1945, one of which, however, was merely to clarify a previous amendment. Increases of 20 cents a barrel were allowed in amendments as follows: Effective January 8, 1945, for Wisconsin, Illinois, Indiana, Western Kentucky, North Dakota, South Dakota, Minnesota, Iowa, and Eastern Missouri; effective August 31, 1945, for Ohio, West Virginia, Michigan, Western Pennsylvania, Western Virginia, and Eastern Kentucky; and effective December 11, 1945, for Nebraska, Kansas, Oklahoma, Arkansas, and Western Missouri. Effective November 10, 1945, an increase of 10 cents a barrel was authorized for Georgia, Alabama, Tennessee, Louisiana, Mississippi, North Carolina, South Carolina, Florida, and Eastern Virginia.

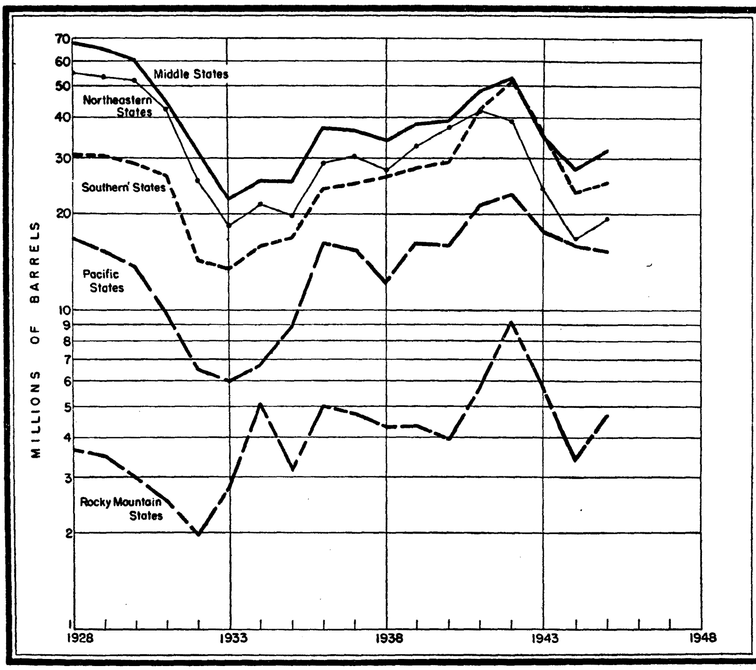

FIGURE 1.—Trends of indicated consumption of portland cement in continental United States, 1928–45, by regions.

PORTLAND CEMENT

PRODUCTION, SHIPMENTS, AND STOCKS

Portland cement constituted 99 percent of the total output of hydraulic cements in 1945. Thus, the general conditions affecting the activity of the portland-cement industry during 1945 were largely those given in the preceding summary.

In 1945 portland cement was manufactured at 141 plants, and shipments were made from 145 plants in 34 States, Hawaii, and

Finished portland cement produced, shipped, and in stock in the United States, 1944–45, by districts

District	Active plants		Production			Shipments from mills								Stocks at mills (Dec. 31)		
			Barrels			1944			1945					Barrels		
							Value			Value		Percent of change from 1944 in—				
	1944	1945	1944	1945	Percent of change from 1944	Barrels	Total	Average	Barrels	Total	Average	Barrels	Average value	1944	1945[1]	Percent of change from 1944
Eastern Pennsylvania and Maryland	22	19	11,845,505	14,511,861	+22.5	12,992,916	$19,350,672	$1.49	15,138,863	$23,838,615	$1.57	+16.5	+5.4	[2] 2,999,591	2,372,589	−20.9
New York and Maine	11	11	4,180,453	5,617,380	+34.4	4,639,660	7,263,746	1.57	5,974,500	9,749,672	1.63	+28.8	+3.8	[2] 1,724,861	1,367,741	−20.7
Ohio	9	8	3,911,337	4,604,294	+17.7	4,129,017	5,957,819	1.44	4,833,183	7,356,271	1.52	+17.1	+5.6	[2] 893,134	664,245	−25.6
Western Pennsylvania and West Virginia	8	8	2,699,134	3,100,859	+14.9	3,272,191	4,695,181	1.43	3,248,624	5,002,388	1.54	−.7	+7.7	[2] 890,168	742,403	−16.6
Michigan	8	7	5,218,620	5,839,190	+11.9	5,177,176	7,733,185	1.49	6,243,322	9,937,834	1.59	+20.6	+6.7	1,835,577	1,431,445	−22.0
Illinois	4	4	3,154,196	4,366,928	+38.4	3,419,815	5,325,796	1.56	4,189,449	7,089,118	1.69	+22.5	+8.3	[2] 643,949	821,428	+27.6
Indiana, Kentucky, and Wisconsin	6	6	4,809,428	6,224,200	+29.4	5,699,484	8,685,669	1.52	6,426,018	10,401,400	1.62	+12.7	+6.6	[2] 1,040,789	838,971	−19.4
Alabama	6	6	4,702,911	5,541,591	+17.8	4,553,664	6,777,741	1.49	5,682,692	8,359,286	1.47	+24.8	−1.3	[2] 625,972	484,871	−22.5
Tennessee	6	6	3,852,618	2,881,505	−25.2	3,811,780	6,080,921	1.60	2,898,053	4,669,330	1.61	−24.0	+.6	[2] 631,095	614,547	−2.6
Virginia, Georgia, Florida, and Louisiana	6	6	4,625,911	4,744,080	+2.6	4,678,599	7,723,315	1.65	4,679,641	7,776,776	1.66	+.02	+.6	[2] 473,294	537,733	+13.6
Iowa	5	5	3,383,082	3,194,164	−5.6	3,408,616	5,677,787	1.67	3,527,838	6,220,991	1.76	+3.5	+5.4	[2] 1,296,495	962,821	−25.7
Eastern Missouri, Minnesota, and South Dakota	6	6	3,749,267	3,860,978	+3.0	3,455,654	5,562,540	1.61	4,351,766	7,395,708	1.70	+25.9	+5.6	[2] 1,452,276	961,488	−33.8
Kansas	6	6	2,818,777	3,000,731	+6.5	2,866,946	4,454,060	1.55	3,298,923	5,157,991	1.56	+15.1	+.6	[2] 1,134,751	836,559	−26.3
Western Missouri, Nebraska, Oklahoma, and Arkansas	6	6	3,043,493	3,469,932	+14.0	3,124,301	5,128,708	1.64	3,593,201	5,829,009	1.62	+15.0	−1.2	851,008	727,739	−14.5
Texas	10	10	6,136,052	8,036,515	+31.0	6,261,931	11,138,156	1.78	8,388,159	14,790,545	1.76	+34.0	−1.1	[2] 1,007,984	656,340	−34.9
Colorado, Wyoming, Montana, Utah, and Idaho	8	8	2,698,558	3,021,587	+12.0	2,490,136	4,925,139	1.98	3,117,821	6,176,878	1.98	+25.2	------	[2] 615,535	519,301	−15.6
California	13	11	14,650,600	15,951,762	+8.9	14,977,023	22,645,600	1.51	15,921,965	23,517,146	1.48	+6.3	−2.0	[2] 1,242,877	1,272,674	+2.4
Oregon and Washington	9	9	4,403,320	3,372,943	−23.4	4,322,283	9,006,058	2.08	3,342,388	7,048,478	2.11	−22.7	+1.4	[2] 527,441	557,996	+5.8
Puerto Rico	2	2	1,022,434	1,442,305	+41.1	990,689	2,225,661	2.25	1,474,447	2,951,348	2.00	+48.8	−11.1	65,251	33,109	−49.3
Hawaii (new mill)	----	1	[3]	22,079	-------	[3]	[3]	[3]	22,742	68,226	3.00	------	------	663	----------	−100.0
	151	145	90,905,696	102,804,884	+13.1	94,271,881	150,357,754	1.59	106,353,595	173,337,010	1.63	+12.8	+2.5	[2] 19,952,711	16,404,000	−17.8
Pennsylvania	25	22	12,338,720	15,563,738	+26.1	13,918,172	20,689,765	1.49	16,232,722	25,549,621	1.57	+16.6	+5.4	[2] 3,463,723	2,794,739	−19.3
Missouri	5	5	3,478,053	3,185,227	−8.4	3,061,434	4,881,516	1.59	3,681,632	6,134,452	1.67	+20.3	+5.0	[2] 1,285,097	788,692	−38.6

[1] Subject to revision.
[2] Revised figures.
[3] Data not available.

Production, shipments from mills, and stocks at mills of finished portland cement in the United States in 1945, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania and Maryland	789	613	684	854	1,106	1,408	1,361	1,534	1,398	1,671	1,589	1,486
New York and Maine	317	208	291	367	458	515	538	588	547	624	650	515
Ohio	261	277	229	331	355	340	401	380	475	579	505	471
Western Pennsylvania and West Virginia	92	171	263	238	238	218	246	387	280	376	307	285
Michigan	187	149	171	351	412	629	654	542	569	690	728	771
Illinois	335	315	331	337	354	328	267	377	424	469	479	366
Indiana, Kentucky, and Wisconsin	394	371	490	398	501	528	595	569	601	717	654	400
Alabama	397	347	415	413	455	410	472	509	545	545	525	508
Tennessee	125	58	108	199	223	234	247	300	328	368	418	275
Virginia, Georgia, Florida, and Louisiana	324	257	342	389	398	396	388	408	416	462	459	495
Iowa	219	90	200	225	181	214	200	319	480	387	365	321
Eastern Missouri, Minnesota, and South Dakota	152	135	182	219	217	316	310	313	434	560	509	512
Kansas	261	135	174	145	238	232	265	363	219	331	381	251
Western Missouri, Nebraska, Oklahoma, and Arkansas	195	158	241	276	286	329	304	367	323	302	345	349
Texas	553	465	576	566	651	661	726	715	685	812	801	831
Colorado, Wyoming, Montana, Utah, and Idaho	173	95	122	130	273	305	317	354	296	304	333	320
California	1,258	1,191	1,226	1,257	1,396	1,439	1,538	1,475	1,364	1,431	1,211	1,174
Oregon and Washington	269	243	250	268	238	303	278	288	305	346	299	286
Puerto Rico	78	93	103	121	104	122	127	130	136	130	144	155
Hawaii [1]	(2)	(2)	(2)	(2)	2	2	3	3	1	----------	3	1
United States: 1945	6,379	5,371	6,398	7,084	8,086	8,929	9,237	9,921	9,826	11,104	10,705	9,772
1944	6,322	5,686	6,139	6,463	7,181	7,906	8,516	9,003	8,739	9,194	8,304	7,387
SHIPMENTS												
Eastern Pennsylvania and Maryland	502	447	1,061	1,215	1,473	1,525	1,469	1,622	1,535	1,865	1,573	836
New York and Maine	119	106	268	426	587	645	674	684	703	800	644	316
Ohio	107	124	263	333	393	465	508	595	613	697	497	237
Western Pennsylvania and West Virginia	94	115	222	250	257	291	323	397	390	448	312	141
Michigan	103	130	271	384	472	596	662	771	853	1,021	670	310
Illinois	82	106	175	252	270	365	420	582	600	791	392	158
Indiana, Kentucky, and Wisconsin	181	217	332	438	517	629	674	789	793	965	625	269
Alabama	383	349	451	437	505	516	541	551	481	560	547	360
Tennessee	148	149	201	204	254	236	265	343	309	380	277	134
Virginia, Georgia, Florida, and Louisiana	290	279	417	367	409	397	397	406	357	510	523	329
Iowa	64	101	191	221	256	389	355	420	623	576	249	85
Eastern Missouri, Minnesota, and South Dakota	135	167	244	251	322	408	457	537	511	733	412	174
Kansas	123	130	236	244	282	282	265	349	339	457	398	196

See footnotes at end of table.

Production, shipments from mills, and stocks at mills of finished portland cement in the United States in 1945, by months and districts, in thousands of barrels—Continued

District	January	February	March	April	May	June	July	August	September	October	November	December
SHIPMENTS—continued												
Western Missouri, Nebraska, Oklahoma, and Arkansas	186	169	245	279	322	281	296	374	386	477	395	185
Texas	512	497	598	572	815	730	758	715	774	790	902	734
Colorado, Wyoming, Montana, Utah, and Idaho	197	127	202	199	293	333	312	303	296	343	267	247
California	1, 381	1, 063	1, 256	1, 458	1, 398	1, 508	1, 499	1, 548	1, 214	1, 329	1, 267	1, 061
Oregon and Washington	175	199	244	252	327	353	283	361	315	407	234	191
Puerto Rico	91	97	111	112	118	132	121	117	118	154	155	148
Hawaii [1]	(2)	(2)	(2)	(2)	2	2	4	3	1	----------	3	1
United States: 1945	4, 873	4, 572	6, 988	7, 894	9, 272	10, 083	10, 283	11, 467	11, 211	13, 303	10, 342	6, 112
1944	5, 047	5, 055	6, 225	7, 373	8, 784	9, 350	9, 283	10, 758	10, 121	10, 263	7, 380	4, 595
STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	3, 280	3, 446	3, 075	2, 717	2, 350	2, 253	2, 146	2, 065	1, 929	1, 735	1, 753	2, 402
New York and Maine	1, 916	2, 019	2, 041	1, 983	1, 854	1, 725	1, 588	1, 492	1, 337	1, 163	1, 167	1, 366
Ohio	1, 044	1, 197	1, 163	1, 163	1, 124	999	892	677	539	422	430	664
Western Pennsylvania and West Virginia	887	944	984	972	945	872	795	785	675	602	597	742
Michigan	1, 919	1, 938	1, 838	1, 804	1, 744	1, 776	1, 768	1, 528	1, 244	913	971	1, 431
Illinois	902	1, 111	1, 267	1, 351	1, 436	1, 398	1, 245	1, 040	848	526	614	821
Indiana, Kentucky, and Wisconsin	1, 163	1, 317	1, 475	1, 437	1, 432	1, 358	1, 279	1, 086	921	671	707	838
Alabama	637	634	598	577	527	422	353	311	374	359	337	485
Tennessee	608	517	424	419	389	387	369	326	345	332	473	615
Virginia, Georgia, Florida, and Louisiana	520	497	422	444	433	432	418	420	479	431	367	533
Iowa	1, 445	1, 439	1, 448	1, 454	1, 379	1, 205	1, 050	949	806	611	727	963
Eastern Missouri, Minnesota, and South Dakota	1, 468	1, 439	1, 376	1, 344	1, 239	1, 148	1, 000	776	699	526	623	962
Kansas	1, 270	1, 276	1, 214	1, 116	1, 071	1, 021	1, 022	1, 036	916	790	782	837
Western Missouri, Nebraska, Oklahoma, and Arkansas	860	850	846	841	806	853	861	854	792	616	567	730
Texas	1, 051	1, 019	997	990	826	756	724	727	638	660	559	656
Colorado, Wyoming, Montana, Utah, and Idaho	591	558	479	414	396	369	373	425	426	382	446	520
California	1, 133	1, 260	1, 230	1, 026	1, 024	997	1, 036	963	1, 113	1, 216	1, 159	1, 273
Oregon and Washington	619	662	671	687	589	539	536	463	453	393	458	552
Puerto Rico	52	48	40	48	35	25	31	43	61	37	26	33
Hawaii [1]	(2)	(2)	(2)	(2)	----------	----------	----------	----------	----------	----------	----------	----------
United States: 1945	21, 365	22, 171	21, 588	20, 787	19, 599	18, 535	17, 486	15, 966	14, 595	12, 385	12, 763	16, 423
1944	24, 428	25, 073	24, 995	24, 080	22, 455	21, 008	20, 233	18, 482	17, 144	16, 049	16, 993	[3] 19, 863

[1] New mill.

[2] Figures not available by months prior to May.

[3] Revised figure.

Puerto Rico. Four plants shipped from stocks. The leading States, in order of production, were California, Pennsylvania, Texas, Michigan, and Alabama.

Production in 1945 was higher in all but three of the Bureau of Mines' districts in continental United States than in 1944; the increases ranged from 3 percent in the Virginia-Georgia-Florida-Louisiana district to 38 percent in Illinois. Production was lower than in 1944 in Tennessee (25 percent), Iowa (6 percent), and Oregon-Washington (23 percent). Hawaii first reported production in May 1945.

Shipments were greater than in 1944 in all but three districts. The largest gains were in Puerto Rico (49 percent) and Texas (34 percent). Shipments declined 1 percent in the Western Pennsylvania-West Virginia district, 24 percent in Tennessee, and 23 percent in Oregon-Washington.

Stocks of finished cement were 18 percent lower on December 31, 1945, than on the same date in 1944. Declines were registered in all districts except Illinois, Virginia-Georgia-Florida-Louisiana, California, and Oregon-Washington. They followed the same trend as in 1944, reaching a maximum in February and a minimum in October. Stocks of clinker were at reasonably high levels during the first quarter but became progressively smaller, reaching a minimum in November.

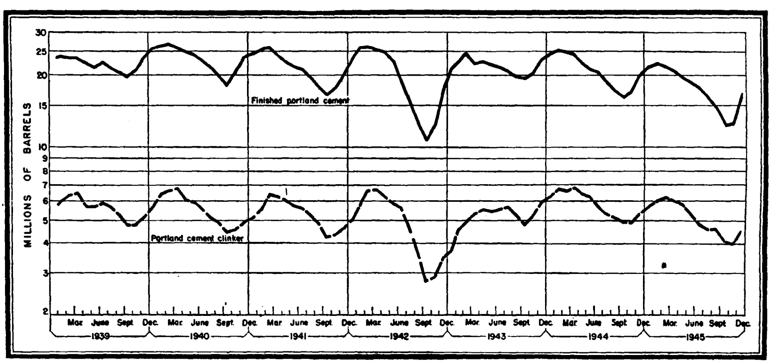

FIGURE 2.—Trends in end-of-month stocks of finished portland cement and portland-cement clinker, 1939–45.

Stocks of finished portland cement and portland-cement clinker at mills in the United States on December 31, and yearly range in end-of-month stocks, 1941–45

	Dec. 31 (barrels)	Range: Low Month	Range: Low Barrels	Range: High Month	Range: High Barrels
1941 Cement	19,964,918	October	16,417,000	March	25,988,000
1941 Clinker	4,575,000	do	4,192,000	do	6,276,000
1942 Cement	17,380,273	do	10,624,000	do	25,832,000
1942 Clinker	3,509,000	do	2,733,000	April	6,656,000
1943 Cement	23,188,975	do	19,583,000	March	24,111,000
1943 Clinker	5,959,000	January	3,771,000	December	5,959,000
1944 Cement	[1] 19,952,711	October	16,019,000	February	25,073,000
1944 Clinker	[1] 5,329,000	November	4,856,000	April	6,687,000
1945 Cement	16,404,000	October	12,385,000	February	22,171,000
1945 Clinker	[2] 4,460,000	November	4,022,000	March	6,185,000

[1] Revised figures. [2] Includes new mill in Hawaii.

DOMESTIC CONSUMPTION

The following table shows that the indicated consumption of portland cement in 1945 gained in all but 11 States. The changes in regional consumption are illustrated in figure 1.

Destination of shipments of finished portland cement from mills in the United States, 1943–45, by States

Destination	1943 (barrels)	1944 (barrels)	1945 Barrels	1945 Percent of change from 1944
Continental:				
Alabama	2,354,265	1,193,825	1,912,267	+60.2
Arizona [1]	997,273	577,030	740,332	+28.3
Arkansas	1,280,188	728,357	974,515	+33.8
California	13,157,805	12,047,681	11,791,720	−2.1
Colorado	951,031	694,058	1,134,256	+63.4
Connecticut [1]	1,094,609	863,538	996,729	+15.4
Delaware [1]	531,444	212,109	210,283	−.9
District of Columbia [1]	1,314,305	667,007	765,140	+14.7
Florida	2,997,035	1,712,942	2,067,746	+20.7
Georgia	2,252,132	1,245,546	1,446,831	+16.2
Idaho	726,204	350,953	431,585	+23.0
Illinois	5,984,967	4,786,504	5,382,144	+12.4
Indiana	3,407,387	2,933,702	3,629,275	+23.7
Iowa	2,156,293	1,996,258	2,186,491	+9.5
Kansas	3,704,782	1,821,219	1,771,706	−2.7
Kentucky	1,836,249	1,258,367	1,205,966	−4.2
Louisiana	2,997,504	1,588,674	1,928,381	+21.4
Maine	439,647	248,306	305,691	+23.1
Maryland	2,620,319	1,595,553	1,655,621	+3.8
Massachusetts [1]	1,467,558	1,084,005	1,298,674	+19.8
Michigan	4,825,804	3,770,473	4,636,388	+23.0
Minnesota	1,533,605	1,638,274	2,134,964	+30.3
Mississippi [1]	784,009	661,707	788,402	+19.1
Missouri	2,543,024	1,969,801	2,579,047	+30.9
Montana	249,583	259,048	355,504	+37.2
Nebraska	2,589,611	1,339,958	1,030,485	−23.1
Nevada [1]	612,035	261,849	310,060	+18.4
New Hampshire [1]	268,157	212,212	253,771	+19.6
New Jersey [1]	3,435,432	2,584,923	2,772,450	+7.3
New Mexico [1]	463,833	382,762	798,601	+108.6
New York	5,931,517	4,057,926	5,251,853	+29.4
North Carolina [1]	3,197,208	2,709,385	1,368,730	−49.5
North Dakota [1]	268,290	286,783	382,307	+33.3
Ohio	6,384,002	4,386,526	4,777,250	+8.9
Oklahoma	3,080,350	1,300,453	1,579,949	+21.5
Oregon	1,008,276	736,067	921,048	+25.1
Pennsylvania	6,512,285	4,798,187	5,474,146	+14.1
Rhode Island [1]	535,352	304,685	266,330	−12.6
South Carolina [1]	1,048,924	555,354	588,720	+6.0
South Dakota	669,736	288,421	383,393	+32.9
Tennessee	3,002,112	1,882,533	1,771,512	−5.9
Texas	7,263,664	5,219,577	6,594,518	+26.3
Utah	1,453,948	611,048	675,278	+10.5
Vermont [1]	117,981	116,599	157,590	+35.2
Virginia	3,495,801	2,434,028	2,065,911	−15.1
Washington	3,700,222	3,338,793	2,304,247	−31.0
West Virginia	1,190,635	902,932	1,080,405	+19.7
Wisconsin	1,801,872	2,259,571	2,608,043	+15.4
Wyoming	383,511	248,343	219,924	−11.5
Unspecified	36,319	184,727	490,825	+165.7
Total continental United States	120,658,095	87,308,579	96,457,004	+10.5
Outside continental United States [2]	6,973,764	6,963,302	9,896,591	+42.1
Total shipped from cement plants	127,631,859	94,271,881	106,353,595	+12.8

[1] Non-cement-producing State.
[2] Direct shipments by producers to foreign countries and to noncontiguous Territories (Alaska, Hawaii, Puerto Rico, etc.), including distribution from Puerto Rican mills; in 1945, includes also distribution from new mill in Hawaii.

Destination of shipments of finished portland cement from mills in the United States in 1945, by months, in barrels

Destination	January	February	March	April	May	June	July	August	September	October	November	December
Alabama	117, 319	95, 638	162, 145	141, 645	149, 082	141, 880	182, 099	223, 030	192, 861	205, 847	195, 971	103, 951
Arizona	42, 800	45, 931	57, 686	63, 846	72, 561	81, 136	70, 752	65, 569	57, 110	66, 671	77, 704	60, 838
Arkansas	59, 119	53, 938	81, 045	73, 057	72, 273	74, 595	97, 694	134, 859	101, 944	90, 957	67, 455	46, 656
California	992, 811	787, 611	949, 831	1, 010, 971	948, 938	995, 367	1, 055, 714	1, 156, 855	955, 194	1, 063, 173	1, 040, 787	896, 241
Colorado	105, 977	35, 195	61, 783	60, 036	107, 071	110, 881	99, 733	97, 485	104, 470	114, 659	115, 534	121, 193
Connecticut	24, 719	19, 693	49, 938	77, 716	81, 476	92, 228	106, 200	113, 254	112, 361	140, 466	116, 679	57, 917
Delaware	5, 640	5, 520	12, 859	16, 782	16, 564	15, 346	15, 624	21, 111	24, 542	33, 739	30, 906	11, 615
District of Columbia	38, 956	37, 530	60, 046	63, 995	87, 819	78, 237	63, 047	74, 707	72, 986	87, 007	75, 090	25, 413
Florida	135, 804	135, 930	151, 699	135, 557	162, 561	155, 916	155, 402	167, 745	165, 167	235, 437	246, 176	220, 044
Georgia	79, 798	76, 359	136, 674	112, 988	115, 214	113, 572	138, 035	149, 606	128, 391	153, 283	159, 017	83, 676
Idaho	18, 233	18, 636	25, 555	34, 962	35, 211	46, 513	42, 823	49, 260	46, 389	54, 256	38, 447	21, 124
Illinois	140, 919	179, 460	286, 060	333, 323	335, 999	469, 231	557, 818	714, 312	690, 646	916, 611	522, 025	208, 540
Indiana	82, 393	109, 804	176, 041	244, 621	317, 578	365, 127	422, 226	481, 713	442, 481	525, 339	326, 419	130, 681
Iowa	34, 813	59, 573	93, 732	126, 921	128, 833	186, 803	187, 730	240, 591	443, 700	493, 537	177, 826	43, 038
Kansas	84, 110	78, 766	146, 953	145, 275	188, 261	157, 457	136, 059	171, 015	158, 280	215, 027	195, 419	94, 762
Kentucky	25, 526	39, 919	53, 045	90, 715	101, 470	108, 655	137, 273	154, 543	151, 491	188, 571	112, 854	41, 638
Louisiana	139, 497	142, 016	160, 410	123, 594	140, 173	141, 154	139, 279	204, 504	192, 840	212, 975	192, 533	134, 297
Maine	4, 251	2, 453	7, 697	18, 596	23, 655	41, 690	35, 789	42, 664	41, 477	50, 304	29, 922	11, 575
Maryland	69, 267	81, 760	163, 319	147, 851	168, 111	159, 708	139, 093	148, 703	143, 566	198, 118	156, 118	60, 547
Massachusetts	30, 854	28, 909	77, 905	100, 717	110, 706	116, 243	134, 309	136, 199	154, 873	185, 645	150, 696	65, 555
Michigan	83, 947	100, 174	208, 193	290, 955	340, 083	437, 818	479, 108	566, 841	624, 814	730, 203	526, 356	247, 863
Minnesota	37, 377	53, 627	112, 731	119, 158	163, 193	227, 944	210, 937	237, 397	301, 873	374, 645	153, 671	59, 399
Mississippi	58, 404	42, 908	64, 206	52, 294	74, 767	74, 437	86, 923	103, 687	81, 567	86, 144	85, 268	62, 009
Missouri	99, 117	110, 831	141, 864	168, 152	199, 500	226, 269	227, 621	298, 864	276, 758	387, 871	303, 175	129, 471
Montana	13, 891	16, 954	30, 024	27, 495	45, 559	33, 088	31, 915	30, 856	39, 005	46, 993	23, 439	22, 532
Nebraska	26, 001	24, 484	56, 603	74, 558	78, 303	86, 509	86, 511	98, 219	130, 976	196, 535	135, 932	35, 738
Nevada	11, 315	11, 915	15, 748	22, 624	26, 214	37, 252	40, 996	33, 198	43, 892	33, 917	15, 862	17, 611
New Hampshire	10, 179	9, 420	13, 906	20, 339	20, 159	21, 676	23, 327	26, 146	33, 051	37, 526	24, 500	11, 921
New Jersey	95, 814	94, 430	181, 033	212, 244	232, 737	246, 096	253, 225	274, 292	292, 334	375, 926	317, 276	166, 132
New Mexico	25, 651	42, 626	76, 620	95, 364	84, 602	79, 721	85, 075	92, 853	53, 478	65, 143	57, 523	68, 773
New York	103, 008	97, 887	286, 255	372, 397	470, 226	497, 585	528, 588	641, 965	634, 367	731, 234	550, 812	245, 185
North Carolina	73, 713	68, 564	119, 569	95, 703	108, 573	118, 444	115, 043	129, 260	114, 086	170, 218	177, 245	75, 720
North Dakota	2, 791	13, 307	22, 134	18, 979	31, 512	73, 856	55, 910	40, 119	42, 237	60, 305	18, 716	4, 642
Ohio	97, 747	111, 140	260, 302	340, 733	387, 097	443, 105	494, 689	595, 277	598, 919	664, 015	508, 136	263, 987
Oklahoma	92, 986	83, 762	116, 250	130, 878	149, 582	121, 561	123, 326	139, 577	142, 170	165, 523	186, 343	127, 516
Oregon	44, 193	48, 138	61, 189	71, 039	82, 967	93, 214	84, 924	98, 082	91, 309	117, 865	66, 883	60, 564
Pennsylvania	145, 391	169, 136	364, 329	425, 108	499, 550	568, 056	570, 321	659, 100	625, 604	775, 633	562, 409	269, 782
Rhode Island	5, 726	4, 664	15, 394	23, 705	25, 102	23, 802	37, 962	28, 045	33, 023	36, 056	24, 391	8, 515
South Carolina	36, 841	32, 625	45, 585	36, 932	45, 470	46, 143	44, 546	62, 234	56, 873	76, 990	68, 224	36, 025
South Dakota	5, 515	8, 836	25, 868	21, 199	34, 025	47, 234	43, 905	32, 649	47, 043	83, 533	24, 091	9, 444
Tennessee	82, 837	76, 214	113, 728	150, 731	184, 034	161, 302	169, 844	188, 963	174, 193	238, 660	164, 002	85, 217
Texas	407, 663	374, 375	463, 164	468, 907	621, 976	589, 931	577, 413	552, 669	621, 393	624, 600	727, 421	554, 635
Utah	42, 388	31, 173	46, 022	58, 148	63, 028	63, 410	54, 309	70, 834	65, 183	74, 265	51, 151	51, 206
Vermont	288	1, 237	7, 331	13, 908	13, 720	16, 785	14, 747	19, 072	22, 240	26, 693	16, 148	4, 948
Virginia	88, 440	91, 742	184, 401	179, 382	217, 430	209, 547	179, 187	200, 794	161, 885	249, 016	223, 265	78, 055

Destination of shipments of finished portland cement from mills in the United States in 1945, by months, in barrels—Continued

Destination	January	February	March	April	May	June	July	August	September	October	November	December
Washington	126, 530	143, 930	174, 650	167, 043	255, 067	252, 620	183, 596	247, 160	210, 264	275, 383	147, 316	120, 280
West Virginia	38, 516	34, 188	63, 089	77, 015	83, 960	105, 832	109, 588	136, 879	124, 285	156, 749	97, 347	51, 923
Wisconsin	53, 464	67, 259	115, 367	157, 391	214, 450	284, 217	255, 747	301, 078	404, 319	438, 316	225, 934	89, 764
Wyoming	8, 271	7, 684	13, 838	11, 594	20, 555	25, 223	20, 911	25, 617	22, 125	28, 531	21, 213	14, 336
Unspecified	20, 355	26, 026	45, 683	77, 398	56, 709	90, 103	123, 260	51, 417	22, 422	1, 687	11, 957	27, 517
Continental United States	4, 171, 165	4, 033, 897	6, 359, 499	7, 104, 541	8, 193, 706	8, 954, 519	9, 230, 153	10, 530, 969	10, 472, 457	12, 561, 797	9, 543, 584	5, 440, 011
Outside continental United States [1]	701, 835	538, 103	628, 501	789, 459	[2] 1, 078, 294	[2] 1, 128, 481	[2] 1, 052, 847	[2] 936, 031	[2] 738, 543	[2] 741, 203	[2] 798, 416	[2] 671, 989
Total	4, 873, 000	4, 572, 000	6, 988, 000	7, 894, 000	9, 272, 000	10, 083, 000	10, 283, 000	11, 467, 000	11, 211, 000	13, 303, 000	10, 342, 000	6, 112, 000

[1] Shipments by producers to foreign countries and to noncontiguous Territories of the United States (Alaska, Hawaii, Puerto Rico, etc.), including distribution from Puerto Rican mills.

[2] Includes distribution from new mill in Hawaii.

LOCAL SUPPLIES

The following table compares the shipments from mills within a State or group of States with the estimated consumption (State receipts of mill shipments) and indicates the surplus or deficiency in the supply of cement locally available. Consumption in the States that do not produce cement is indicated in a preceding table showing shipments into each State. The total surplus of producing States in 1945 was distributed as follows: 11,698,119 barrels to non-cement-producing States; 7,996,682 barrels to destinations outside continental United States (excluding local consumption of Puerto Rican and Hawaiian production); and 490,825 barrels to unspecified destinations.

Estimated surplus or deficiency in local supply of portland cement in cement-producing States, 1944–45, in barrels

State or division	1944			1945		
	Shipments from mills	Estimated consumption	Surplus or deficiency	Shipments from mills	Estimated consumption	Surplus or deficiency
Alabama	4, 553, 664	1, 193, 825	+3, 359, 839	5, 682, 692	1, 912, 267	+3, 770, 425
California	14, 977, 023	12, 047, 681	+2, 929, 342	15, 921, 965	11, 791, 720	+4, 130, 245
Hawaii [1]				22, 742	824, 631	−801, 889
Illinois	3, 419, 815	4, 786, 504	−1, 366, 689	4, 189, 449	5, 382, 144	−1, 192, 695
Iowa	3, 408, 616	1, 996, 258	+1, 412, 358	3, 527, 838	2, 186, 491	+1, 341, 347
Kansas	2, 866, 946	1, 821, 219	+1, 045, 727	3, 298, 923	1, 771, 706	+1, 527, 217
Michigan	5, 177, 176	3, 770, 473	+1, 406, 703	6, 243, 322	4, 636, 388	+1, 606, 934
Missouri	3, 061, 434	1, 969, 801	+1, 091, 633	3, 681, 632	2, 579, 047	+1, 102, 585
Ohio	4, 129, 017	4, 386, 526	−257, 509	4, 833, 183	4, 777, 250	+55, 933
Pennsylvania	13, 918, 172	4, 798, 187	+9, 119, 985	16, 232, 722	5, 474, 146	+10, 758, 576
Puerto Rico	990, 689	831, 561	+159, 128	1, 474, 447	1, 075, 278	+399, 169
Tennessee	3, 811, 780	1, 882, 533	+1, 929, 247	2, 898, 053	1, 771, 512	+1, 126, 541
Texas	6, 261, 931	5, 219, 577	+1, 042, 354	8, 388, 159	6, 594, 518	+1, 793, 641
Colorado, Montana, Utah, Wyoming, and Idaho	2, 490, 136	2, 163, 450	+326, 686	3, 117, 821	2, 816, 547	+301, 274
Oregon and Washington	4, 322, 283	4, 074, 860	+247, 423	3, 342, 388	3, 225, 295	+117, 093
Georgia, Kentucky, Virginia, Florida, and Louisiana	5, 276, 893	8, 239, 557	−2, 962, 664	5, 432, 609	8, 714, 835	−3, 282, 226
Indiana, Wisconsin, Minnesota, Nebraska, Oklahoma, South Dakota, and Arkansas	8, 619, 711	10, 488, 736	−1, 869, 025	9, 936, 385	12, 340, 624	−2, 404, 239
Maryland and West Virginia	2, 346, 935	2, 498, 485	−151, 550	2, 154, 765	2, 736, 026	−581, 261
New York and Maine	4, 639, 660	4, 306, 232	+333, 428	5, 974, 500	5, 557, 544	+416, 956
	94, 271, 881	76, 475, 465	+17, 796, 416	106, 353, 595	86, 167, 969	+20, 185, 626

[1] New mill.

TRANSPORTATION

The proportion of cement shipped by each of the major methods of transportation for 1945 is indicated in the following table. The proportions of total cement shipped by truck, railroad, and boat in 1945 differed little from the proportions recorded for 1944. Railroad shipments account for approximately 80 percent of the total.

Bulk shipments of cement continued to decline. The percentage shipped in bulk in 1943 was 42.2, in 1944, 34.5, and in 1945, only 30 percent. The use of paper bags is increasing, while the percentage shipped in cloth bags shows a steady decline.

Shipments of portland cement from mills in the United States (including Puerto Rico), 1943–45, in bulk and in containers, by types of carriers

[Barrels of 376 pounds]

Type of carrier	In bulk		In containers				Total shipments	
			Bags		Other containers [1]	Total		
			Paper	Cloth				
	Barrels	*Percent*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Barrels*	*Percent*
1943								
Truck	[2] 7,744,131	14.4	7,595,623	3,170,639		10,766,262	18,510,393	14.5
Railroad	44,452,539	82.6	37,688,106	24,345,755	18,513	62,052,374	106,504,913	83.4
Boat	1,622,923	3.0	849,969	143,661		993,630	2,616,553	2.1
	53,819,593	100.0	46,133,698	27,660,055	18,513	73,812,266	127,631,859	100.0
Percent of total	42.2		36.1	21.7	(3)	57.8	100.0	
1944								
Truck	[2] 5,602,744	17.2	7,230,578	2,814,618		10,045,196	15,647,940	16.6
Railroad	25,279,796	77.7	35,041,534	15,257,760	9,207	50,308,501	75,588,297	80.2
Boat	1,648,229	5.1	1,273,520	113,895		1,387,415	3,035,644	3.2
	32,530,769	100.0	43,545,632	18,186,273	9,207	61,741,112	94,271,881	100.0
Percent of total	34.5		46.2	19.3	(3)	65.5	100.0	
1945 [4]								
Truck	[2] 6,131,239	19.2	9,185,986	2,688,601		11,874,587	18,005,826	16.9
Railroad	24,407,302	76.4	44,831,347	15,650,807	21,954	60,504,108	84,911,410	79.9
Boat	1,391,294	4.4	1,916,118	128,947		2,045,065	3,436,359	3.2
	31,929,835	100.0	55,933,451	18,468,355	21,954	74,423,760	106,353,595	100.0
Percent of total	30.0		52.6	17.4	(3)	70.0	100.0	

[1] Includes steel drums and iron and wood barrels.
[2] Includes cement used at mills by producers as follows—1943: 153,337 barrels; 1944: 112,593 barrels; 1945: 217,968 barrels.
[3] Less than 0.05 percent.
[4] Includes new mill in Hawaii; product shipped in paper bags by truck and railroad

MILL VALUES

The average net mill realization of all portland cement shipped from mills in 1945 advanced to $1.63 per barrel from $1.59 in 1944. The gain in average mill return resulted from the increases in ceiling prices allowed for certain areas, to which reference has been made on a preceding page.

The composite wholesale price of portland cement, f. o. b. destination, according to the Bureau of Labor Statistics index (1926=100), was 99.4 in 1945; in 1944 it was 95.8.

Average mill value per barrel, in bulk, of portland cement in the United States, 1941–45

1941	$1.47	1944	$1.59
1942	1.53	1945	1.63
1943	1.57		

CAPACITY OF PLANTS

The aggregate annual capacity of all portland-cement plants in 1945 increased 1,100,000 barrels over 1944. The increase was due chiefly to extensions and improvements at old plants and includes approximately 75,000 barrels capacity for finished portland cement of 1 new plant that began operating during the year. The capacity of

1 plant reported dismantled late in 1944 has been excluded from the figures for 1945. Data for 1945 are based on 154 mills, including 1 new mill (Hawaii). The over-all rate of operation in 1945 was at 43 percent of total capacity. As indicated in the following table, the percentage of capacity utilized in 1945 gained in all districts except Tennessee, Virginia-Georgia-Florida-Louisiana, Iowa, and Oregon-Washington.

Portland-cement-manufacturing capacity of the United States, 1944–45, by producing districts

District	Estimated capacity (barrels)		Percent of capacity utilized	
	1944	1945	1944	1945
Eastern Pennsylvania and Maryland	41,608,420	42,567,325	28.5	34.1
New York and Maine	16,740,208	17,171,715	25.0	32.7
Ohio	12,308,515	12,191,515	31.8	37.8
Western Pennsylvania and West Virginia	13,651,300	13,651,300	19.8	22.7
Michigan	13,248,920	13,598,920	39.4	42.9
Illinois	9,590,537	9,864,510	32.9	44.3
Indiana, Kentucky, and Wisconsin	17,090,027	17,264,000	28.1	36.1
Alabama	9,564,707	9,420,810	49.2	58.8
Tennessee	7,307,000	7,417,000	52.7	38.9
Virginia, Georgia, Florida, and Louisiana	7,338,904	7,580,000	63.0	62.6
Iowa	7,330,685	7,930,000	46.1	40.3
Eastern Missouri, Minnesota, and South Dakota	11,164,295	11,129,295	33.6	34.7
Kansas	8,869,795	9,215,000	31.8	32.6
Western Missouri, Nebraska, Oklahoma, and Arkansas	7,550,000	7,550,000	40.3	46.0
Texas	14,080,000	14,080,000	43.6	57.1
Colorado, Wyoming, Montana, Utah, and Idaho	5,465,000	5,465,000	49.4	55.3
California	28,640,000	26,490,000	51.2	60.2
Oregon and Washington	7,363,288	7,350,000	59.8	45.9
Puerto Rico	1,620,000	1,620,000	63.1	89.0
Hawaii (new mill)		75,000		29.4
	240,531,601	241,631,390	37.8	42.5

The percentage of capacity used in each month of 1945 was higher than in the corresponding month of 1944, except in February, when they were the same. The monthly rate was lowest in January, February, and March 1945. It increased steadily thereafter until October. The recessions in November and December were much smaller than the average seasonal declines. In the following table, cement plants are grouped according to size.

Distribution of portland-cement plants in the United States in 1945, according to annual capacity

Estimated annual capacity, barrels:	*Number of plants*
Less than 1,000,000	38
1,000,000 to 1,999,000	84
2,000,000 to 2,999,000	21
Between 2,999,000 and 10,000,000	11
	154

Percent of capacity used in the finished portland-cement industry in the United States, 1944–45

Month	Monthly 1944	Monthly 1945	12 months ended— 1944	12 months ended— 1945	Month	Monthly 1944	Monthly 1945	12 months ended— 1944	12 months ended— 1945
January	30	31	51	37	July	41	45	41	39
February	29	29	49	37	August	44	49	40	40
March	29	31	47	38	September	44	50	39	40
April	32	36	46	38	October	45	55	38	41
May	35	40	44	39	November	42	54	38	42
June	40	45	43	39	December	36	48	37	43

The total capacity of wet-process mills was higher than that of dry-process mills, and wet-process capacity gained slightly over the dry-mill capacity in 1945, as indicated in the accompanying table; however, the percentage of total cement produced by the wet process in 1945 was lower than in 1944.

Capacity of portland-cement plants in the United States (including Puerto Rico), 1943–45, by processes

Process	Capacity: Thousands of barrels 1943	1944	1945[1]	Capacity: Percent of total 1943	1944	1945[1]	Percent of capacity utilized 1943	1944	1945[1]	Percent of total finished cement produced 1943	1944	1945[1]
Wet	122,702	123,637	124,688	50.6	51.4	51.6	59.5	42.2	45.9	54.7	57.4	55.6
Dry	119,758	116,895	116,943	49.4	48.6	48.4	50.4	33.1	39.0	45.3	42.6	44.4
	242,460	240,532	241,631	100.0	100.0	100.0	55.0	37.8	42.5	100.0	100.0	100.0

[1] Includes new dry-process mill in Hawaii.

CLINKER PRODUCTION

The output of clinker, the intermediate product of the industry, was 13 percent greater in 1945 than in 1944. The growing demand for cement is reflected in the 16-percent decline in stocks of clinker as of December 31, 1945, compared with those on hand a year earlier.

Production and stocks of portland-cement clinker at mills in the United States in 1945, by months and districts, in thousands of barrels

District	January	February	March	April	May	June	July	August	September	October	November	December
PRODUCTION												
Eastern Pennsylvania and Maryland	936	768	830	775	1,031	1,225	1,299	1,449	1,450	1,579	1,588	1,553
New York and Maine	329	240	349	375	376	450	482	565	572	678	674	517
Ohio	298	245	242	301	332	348	347	416	460	536	513	479
Western Pennsylvania and West Virginia	228	192	209	216	246	257	287	314	294	233	352	336
Michigan	164	139	161	395	477	525	570	572	567	707	756	741
Illinois	345	321	372	356	373	329	272	378	394	502	507	350
Indiana, Kentucky, and Wisconsin	503	445	446	453	445	481	560	547	567	611	653	626
Alabama	411	391	379	394	462	421	448	492	538	576	531	498
Tennessee	127	41	106	139	272	227	234	385	401	330	357	354
Virginia, Georgia, Florida, and Louisiana	343	270	357	382	421	381	411	417	436	490	477	508
Iowa	250	169	211	212	166	226	228	313	398	387	386	363
Eastern Missouri, Minnesota, and South Dakota	210	124	202	227	186	229	205	286	336	430	480	528
Kansas	195	180	160	158	219	235	296	336	228	338	365	257
Western Missouri, Nebraska, Oklahoma, and Arkansas	203	167	229	275	299	333	297	353	338	287	320	358
Texas	508	380	562	548	669	720	753	707	688	847	791	866
Colorado, Wyoming, Montana, Utah, and Idaho	159	109	134	127	258	315	302	331	279	295	315	226
California	1,219	1,151	1,282	1,204	1,354	1,398	1,552	1,491	1,515	1,421	1,310	1,383
Oregon and Washington	263	231	268	293	264	218	211	245	303	315	284	287
Puerto Rico	112	92	52	116	135	98	119	144	147	125	101	132
Hawaii [1]	[2]	[2]	[2]	[2]	3	----------	3	2	1	----------	4	1
United States: 1945	6,803	5,655	6,551	6,946	7,988	8,416	8,876	9,743	9,912	10,687	10,764	10,363
1944	6,688	5,949	6,169	6,547	6,994	7,686	7,984	8,787	8,546	9,015	8,321	7,823
STOCKS (END OF MONTH)												
Eastern Pennsylvania and Maryland	894	1,046	1,185	1,092	1,015	822	754	661	706	618	588	596
New York and Maine	138	169	230	283	236	209	183	180	214	271	296	309
Ohio	352	326	336	301	281	275	223	250	230	183	181	188
Western Pennsylvania and West Virginia	402	419	375	334	305	310	313	240	242	127	166	201
Michigan	438	430	403	440	488	375	271	291	316	301	292	285
Illinois	28	34	68	82	96	92	91	82	24	46	61	39
Indiana, Kentucky, and Wisconsin	432	506	457	502	443	396	352	324	280	171	162	376
Alabama	203	248	210	186	188	199	167	142	132	152	149	136
Tennessee	160	143	140	79	128	121	93	178	248	201	131	211
Virginia, Georgia, Florida, and Louisiana	69	78	83	67	83	63	70	63	74	84	89	93
Iowa	249	328	341	333	323	340	372	363	283	286	312	339
Eastern Missouri, Minnesota, and South Dakota	510	541	604	633	611	554	463	458	360	264	260	281
Kansas	137	176	157	167	144	140	170	138	139	140	108	108

See footnotes at end of table.

Production and stocks of portland-cement clinker at mills in the United States in 1945, by months and districts, in thousands of barrels—Con.

District	January	February	March	April	May	June	July	August	September	October	November	December
STOCKS (END OF MONTH)—continued												
Western Missouri, Nebraska, Oklahoma, and Arkansas	149	152	139	139	139	141	124	112	125	120	92	91
Texas	254	169	155	120	134	179	201	180	171	194	160	172
Colorado, Wyoming, Montana, Utah, and Idaho	292	307	317	314	298	309	295	273	256	246	227	132
California	639	565	625	549	465	397	384	364	500	465	548	734
Oregon and Washington	309	300	320	348	376	293	228	186	185	153	139	142
Puerto Rico	84	86	40	39	76	56	52	71	87	87	59	26
Hawaii [1]	(2)	(2)	(2)	(2)	5	2	2	-------	-------	-------	2	1
United States: 1945	5,739	6,023	6,185	6,012	5,834	5,273	4,808	4,556	4,572	4,109	4,022	4,460
1944	6,329	6,603	6,567	6,687	6,378	6,172	5,577	5,287	5,096	4,862	4,856	[3] 5,329

[1] New mill.
[2] Figures not available by months prior to May.
[3] Revised figure.

Portland-cement clinker produced and in stock at mills in the United States, 1944–45, by processes, in barrels of 376 pounds [1]

Process	Plants		Production		Stock (Dec. 31)	
	1944	1945 [2]	1944 [3]	1945 [2]	1944 [3]	1945 [2 4]
Wet	81	82	52,109,668	56,827,740	2,568,790	2,180,438
Dry	59	58	38,399,135	45,875,236	2,760,196	2,279,654
	140	140	90,508,803	102,702,976	5,328,986	4,460,092

[1] Compiled from monthly estimates of the producers.
[2] Includes new dry-process mill in Hawaii.
[3] Revised figures.
[4] Subject to revision.

PRODUCTION ACCORDING TO RAW MATERIALS

A combination of limestone with clay or shale is the predominant raw material for making portland cement. In 1945, 71.4 percent of the output was made from this combination of raw materials, compared with 72.0 percent in 1944. Cement rock and limestone, which in the early days of the industry were the leading raw materials, now have secondary importance. This combination furnished raw material for 19.8 percent of the cement output in 1945, which was slightly higher than in 1944. Marl, which was used in substantial quantities before 1906, is now of minor importance, supplying raw material for only 2.0 percent of the cement made in 1945. The combination of blast-furnace slag and limestone accounted for 6.8 percent of the output in 1945, compared with 6.3 percent in 1944.

Production and percentage of total output of portland cement in the United States, 1898–1914, 1926, 1929, 1933, 1935, and 1941–45, according to raw materials

Year	Cement rock and pure limestone		Limestone and clay or shale		Marl and clay		Blast-furnace slag and limestone	
	Barrels	Percent	Barrels	Percent	Barrels	Percent	Barrels	Percent
1898	2,764,694	74.9	365,408	9.9	562,092	15.2		
1899	4,010,132	70.9	546,200	9.7	1,095,934	19.4		
1900	5,960,739	70.3	1,034,041	12.2	1,454,797	17.1	32,443	0.4
1901	8,503,500	66.9	2,042,209	16.1	2,001,200	15.7	164,316	1.3
1902	10,953,178	63.6	3,738,303	21.7	2,220,453	12.9	318,710	1.8
1903	12,493,694	55.9	6,333,403	28.3	3,052,946	13.7	462,930	2.1
1904	15,173,391	57.2	7,526,323	28.4	3,332,873	12.6	473,294	1.8
1905	18,454,902	52.4	11,172,389	31.7	3,884,178	11.0	1,735,343	4.9
1906	23,896,951	51.4	16,532,212	35.6	3,958,201	8.5	2,076,000	4.5
1907	25,859,095	53.0	17,190,697	35.2	3,606,598	7.4	2,129,000	4.4
1908	20,678,693	40.6	23,047,707	45.0	2,811,212	5.5	4,535,300	8.9
1909	24,274,047	37.3	32,219,365	49.6	2,711,219	4.2	5,786,800	8.9
1910	26,520,911	34.6	39,720,320	51.9	3,307,220	4.3	7,001,500	9.2
1911	26,812,129	34.1	40,665,332	51.8	3,314,176	4.2	7,737,000	9.9
1912	24,712,780	30.0	44,607,776	54.1	2,467,368	3.0	10,650,172	12.9
1913	29,333,490	31.8	47,831,863	51.9	3,734,778	4.1	11,197,000	12.2
1914	24,907,047	28.2	50,168,813	56.9	4,038,310	4.6	9,116,000	10.3
1926	44,090,657	26.8	[1] 101,637,866	61.8	3,324,408	2.0	15,477,239	9.4
1929	51,077,034	29.9	[1] 97,623,502	57.2	4,832,700	2.9	17,112,800	10.0
1933	14,135,171	22.3	[1] 43,638,023	68.7	1,402,744	2.2	4,297,251	6.8
1935	23,811,687	31.0	[1] 45,073,144	58.8	1,478,569	1.9	6,378,170	8.3
1941	46,534,193	28.4	[1] 102,285,699	62.3	3,142,021	1.9	12,068,646	7.4
1942	49,479,304	27.0	[1] 115,948,373	63.4	3,009,562	1.7	14,343,945	7.9
1943	29,915,157	22.4	[1] 92,310,018	69.2	2,300,636	1.7	8,897,977	6.7
1944	17,609,055	19.4	[1] 65,478,178	72.0	2,078,530	2.3	5,739,933	6.3
1945	20,383,505	19.8	[1] 73,409,831	71.4	2,035,236	2.0	6,976,312	6.8

[1] Includes output of 2 plants using oystershells and clay in 1926; 3 plants in 1929, 1933, and 1935; and 4 plants in 1941–45.

RAW MATERIALS

The tonnages of raw materials (exclusive of fuels and explosives) required for the production of portland cement during recent years are given in the following table.

Raw materials used in producing portland cement in the United States, 1943–45

Raw material	1943	1944	1945
	Short tons	*Short tons*	*Short tons*
Cement rock	8, 564, 458	5, 119, 318	5, 656, 390
Limestone [1]	28, 598, 436	19, 958, 151	22, 747, 654
Marl	699, 456	643, 412	646, 391
Clay and shale [2]	4, 004, 316	2, 822, 881	3, 162, 458
Blast-furnace slag	544, 084	278, 998	380, 970
Gypsum	850, 660	597, 297	683, 158
Sand and sandstone [3]	350, 941	230, 288	272, 077
Iron materials [4]	188, 096	123, 079	128, 312
Miscellaneous [5]	38, 542	22, 442	36, 100
Total	43, 838, 989	29, 795, 866	33, 713, 510
Average total weight required per barrel (376 pounds) of finished cement	*Pounds* 657	*Pounds* 656	*Pounds* 656

[1] Includes oystershells.
[2] Includes bentonite, diatomaceous shale, fuller's earth, and other clays.
[3] Includes silica and quartz.
[4] Includes iron ore, pyrite cinders and ore, and mill scale.
[5] Includes diatomite, fluorspar, pumicite, flue dust, pitch, red mud and rock, hydrated lime, tufa, cinders, calcium chloride, sludge, grinding aids, and air-entraining compound.

FUELS AND POWER

In consonance with the increasing tempo of cement production in 1945, consumption of all types of fuel increased. Stocks of fuels were generally low. They were sufficient for only 1½ to 2 months' operations at the average rate of consumption throughout the year.

Finished portland cement produced and fuel consumed by the portland-cement industry in the United States, 1944–45, by processes

Process	Finished cement produced			Fuel consumed [1]		
	Plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1944						
Wet	[2] 83	[2] 52, 157, 819	[2] 57.4	[2] 2, 001, 165	1, 525, 242	23, 476, 342
Dry	[2] 60	[2] 38, 747, 877	[2] 42.6	[2] 1, 737, 522	1, 050, 430	12, 111, 214
	143	90, 905, 696	100.0	[3] 3, 738, 687	2, 575, 672	35, 587, 556
1945 [4]						
Wet	81	57, 192, 688	55.6	2, 126, 895	1, 828, 788	26, 340, 213
Dry	60	45, 612, 196	44.4	2, 078, 329	1, 215, 738	12, 833, 720
	141	102, 804, 884	100.0	[5] 4, 205, 224	3, 044, 526	39, 173, 933

[1] Figures compiled from monthly estimates of the producers.
[2] Revised figures.
[3] Includes 21,956 tons of anthracite and 3,716,731 tons of bituminous coal.
[4] Includes new dry-process mill in Hawaii.
[5] Includes 12,004 tons of anthracite and 4,193,220 tons of bituminous coal.

Portland cement produced in the United States, 1944–45, by kinds of fuel

Fuel	Finished cement produced			Fuel consumed [1]		
	Number of plants	Barrels of 376 pounds	Percent of total	Coal (short tons)	Oil (barrels of 42 gallons)	Natural gas (M cubic feet)
1944						
Coal	86	[2] 49, 279, 289	54.2	3, 095, 944		
Oil	11	[2] 8, 154, 580	9.0		1, 758, 259	
Natural gas	12	[2] 6, 538, 785	7.2			10, 247, 327
Coal and oil	9	7, 626, 823	8.4	478, 493	414, 576	
Coal and natural gas	14	7, 798, 219	8.6	150, 157		11, 547, 190
Oil and natural gas	6	8, 791, 018	9.6		334, 027	9, 885, 310
Coal, oil, and natural gas	5	2, 716, 982	3.0	14, 093	68, 810	3, 907, 729
	143	90, 905, 696	100.0	[3] 3, 738, 687	2, 575, 672	35, 587, 556
1945 [4]						
Coal	84	[2] 54, 864, 433	53.3	3, 481, 492		
Oil	13	[2] 9, 739, 804	9.5		1, 988, 197	
Natural gas	12	[2] 9, 440, 052	9.2			13, 413, 573
Coal and oil	9	9, 217, 452	9.0	563, 467	498, 504	
Coal and natural gas	15	8, 081, 634	7.9	158, 132		[5] 11, 889, 766
Oil and natural gas	5	9, 575, 071	9.3		528, 107	10, 991, 059
Coal, oil, and natural gas	3	1, 886, 438	1.8	2, 133	29, 718	2, 879, 535
	141	102, 804, 884	100.0	[6] 4, 205, 224	3, 044, 526	39, 173, 933

[1] Figures compiled from monthly estimates of the producers.
[2] Average consumption of fuel per barrel of cement produced was as follows: 1944—Coal, 125.6 pounds; oil, 0.2156 barrel; natural gas, 1,567 cubic feet. 1945—Coal, 126.9 pounds; oil, 0.2041 barrel; natural gas, 1,421 cubic feet.
[3] Includes 21,956 tons of anthracite and 3,716,731 tons of bituminous coal.
[4] Includes new mill in Hawaii, using oil only.
[5] Includes 824,665 M cu. ft. of byproduct gas.
[6] Includes 12,004 tons of anthracite and 4,193,220 tons of bituminous coal.

Electric energy used at portland-cement-producing plants in the United States, 1944–45, by processes, in kilowatt-hours

Process	Electric energy used						Finished cement produced (barrels)	Average electric energy used per barrel of cement produced (kilowatt-hours)
	Generated at portland-cement plants		Purchased		Total			
	Active plants	Kilowatt-hours	Active plants	Kilowatt-hours	Kilowatt-hours	Percent		
1944								
Wet	27	436, 937, 724	75	912, 052, 832	1, 348, 990, 556	57.6	52, 157, 819	25.9
Dry	31	589, 948, 127	51	404, 209, 961	994, 158, 088	42.4	38, 747, 877	25.7
	58	1, 026, 885, 851	126	1, 316, 262, 793	2, 343, 148, 644	100.0	90, 905, 696	25.8
Percent of total electric energy used		43.8		56.2	100.0			
1945 [1]								
Wet	30	463, 905, 324	72	889, 558, 105	1, 353, 463, 429	53.9	57, 192, 688	23.7
Dry	30	654, 943, 970	49	503, 676, 105	1, 158, 620, 075	46.1	45, 612, 196	25.4
	60	1, 118, 849, 294	121	1, 393, 234, 210	2, 512, 083, 504	100.0	102, 804, 884	24.4
Percent of total electric energy used		44.5		55.5	100.0			

[1] Includes new dry-process mill in Hawaii.

TYPES OF CEMENT

A breakdown of total production of portland cement in 1945, by various types, is presented in the following table. The drop in sales of low-heat type IV to less than one-tenth of the 1944 figure is noteworthy. Sales of all other types increased.

Prepared masonry mortars.—Production of these mixed materials in 1945 from 70 plants totaled 4,017,531 barrels, and shipments 3,929,710 barrels, valued at $6,545,218, an average mill realization of $1.67 a barrel. These data are not included in the statistics of this chapter, but the portland cement used in producing the mixtures is included.

Portland cement produced and shipped in the United States, 1941–45, by types

Kind and year	Active plants	Production (barrels)	Shipments		
			Barrels	Value	
				Total	Average
General use and moderate heat (types I and II):					
1943 [1]	153	123,490,667	118,347,297	$182,682,614	$1.54
1944 [2]	151	83,576,685	86,933,387	135,564,313	1.56
1945 [2 3]	145	94,998,226	98,282,835	156,427,366	1.59
High-early-strength (type III):					
1941	90	6,063,638	6,123,224	11,443,792	1.87
1942	87	7,523,647	7,065,700	13,683,665	1.94
1943	95	6,816,671	6,299,190	12,040,467	1.91
1944	97	5,135,264	5,190,092	10,278,215	1.98
1945	103	5,487,460	5,602,875	11,280,392	2.01
Low-heat (type IV):					
1943 [1]	4	1,710,617	1,687,277	2,316,755	1.37
1944	4	441,368	400,998	554,684	1.38
1945	3	35,715	30,840	50,358	1.63
Sulfate-resisting (type V):					
1941	9	342,400	353,885	544,767	1.54
1942	8	79,835	77,015	136,939	1.78
1943	5	24,419	20,697	40,933	1.98
1944	4	100	1,647	3,280	1.99
1945	4	5,141	3,915	7,952	2.03
Oil-well:					
1941	19	786,167	806,364	1,550,301	1.92
1942	17	537,541	552,157	1,100,296	1.99
1943	16	630,412	544,436	1,050,178	1.93
1944	15	938,872	931,371	1,802,361	1.94
1945	16	1,231,756	1,305,493	2,499,739	1.91
White:					
1941	4	538,752	549,293	2,191,289	3.99
1942	5	345,613	306,120	1,214,422	3.97
1943	6	318,470	335,110	1,340,201	4.00
1944	6	302,543	322,443	1,303,440	4.04
1945	5	425,299	456,210	1,859,070	4.08
Portland-puzzolan:					
1941	8	441,500	439,354	632,713	1.44
1942	7	324,002	329,637	465,627	1.41
1943	4	215,026	221,182	311,230	1.41
1944	4	290,013	244,858	337,250	1.38
1945	3	212,156	250,944	389,482	1.55
Miscellaneous: [4]					
1941	14	668,655	667,206	1,058,108	1.59
1942	12	242,170	269,705	468,083	1.74
1943	23	217,506	176,670	320,838	1.82
1944	21	220,851	247,085	514,211	2.08
1945	11	409,131	420,483	822,651	1.96

[1] Figures reported separately for the first time in 1943.
[2] Includes air-entrained and Vinsol resin cements classed as modified cements by producers.
[3] Includes new mill in Hawaii.
[4] 1941–42: Includes hydroplastic portland cements; 1943–45: Includes hydroplastic, plastic, and waterproofed cements.

NEW DEVELOPMENTS

A new use for cement that may be extended greatly in the future is for grouting railroad ballast. Quite a number of railroad companies in the United States are using the process to some extent in treating water pockets and soft spots in road beds. Two methods of pressure grouting are used. By the earlier method, pneumatic pressure was applied to neat cement or very rich mixtures. Today the most popular method is to use lean mixtures injected by hydraulic pressure. The cement is applied through "grouting points" driven into the ballast a few feet apart and to depths of 5 or 6 feet. Grouting increases stability and reduces track maintenance expense.

Lining new oil-field pipe with cement is not new, but during the war the process was used extensively for reconditioning used pipe that would otherwise be discarded as scrap. The incentive behind this movement was the acute shortage of iron and steel for pipe manufacture. Many used pipes were relined with cement in the Illinois, Oklahoma, Kansas, and Texas oil fields.

Interest grows in air-entrained cements used in highway construction because of their superior resistance to freezing and thawing. Much research has been conducted during the past year to determine optimum percentages of reagent additions and the behavior of reagents under varying conditions. It was found that the heat generated in clinker grinding might be high enough to volatilize a considerable part of a commonly used reagent—vinsol resin. Air entraining has recently been extended to concrete-block manufacture.

Recent significant trends in the cement industry are toward increasing the length of kilns and adding clinker-cooling equipment or improving that already in use.

The scarcity of lumber and the high price levels attained for it compared with prices of other building materials have stimulated a much wider use of cement blocks as substitutes for lumber. This use of cement has therefore experienced a substantial growth.

The Bureau of Mines has recently published a report [1] describing the cement industry in Mexico, South and Central America, and the adjacent islands.

NATURAL, MASONRY (NATURAL), AND PUZZOLAN CEMENTS

Production and shipments of the group of hydraulic cements other than portland in 1945 increased 19 and 12 percent, respectively, from the previous year. Stocks increased 3 percent. Producers reported a consumption of 23,944 short tons of coal and of gas equivalent to approximately 265 short tons of coal.

[1] Bowles, Oliver, and Taeves, A., Cement in Latin America: Bureau of Mines Inf. Circ. 7360, 1946, 51 pp.

Natural, masonry (natural), and puzzolan (slag-lime) cements produced, shipped, and in stock at mills in the United States, 1941–45

Year	Production		Shipments		Stock (Dec. 31)
	Active plants	Barrels (376 pounds)	Barrels (376 pounds)	Value	Barrels (376 pounds)
1941	12	2,875,962	2,926,203	$3,967,567	199,365
1942	11	2,560,425	2,508,324	3,668,169	253,307
1943	10	1,830,266	1,846,803	2,357,112	227,152
1944	9	1,246,703	1,320,274	1,638,892	[1] 166,889
1945	9	1,483,763	1,479,513	2,093,848	[2] 171,139

[1] Revised figure.
[2] Subject to revision.

TRENDS IN EMPLOYMENT AND OUTPUT PER MAN

In Minerals Yearbooks, 1935 (pp. 891–905) and 1940, Review of 1939 (pp. 1141–1153), trends in employment and output per man in the cement industry were traced from 1928 to 1938. Similar data for 1939 and 1940 appeared in Minerals Yearbook, 1941 (pp. 1215–1222), and for 1941 and 1942 in Minerals Yearbook, 1943 (pp. 1265–1273). The study is continued herein through 1943 and 1944.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1940–44 (excluding Puerto Rico)

Year	Employment					Production			Percent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours					
				Average per man per day	Total		Per shift	Per hour	
1940	26,038	279	7,276,469	7.4	54,116,153	129,830,687	17.84	2.40	99.7
1941	28,409	303	8,600,572	7.4	63,636,617	163,567,931	19.02	2.57	99.7
1942	29,768	315	9,374,851	7.5	70,203,687	182,114,486	19.43	2.59	99.6
1943	25,453	300	7,626,376	7.7	58,737,442	132,445,838	17.37	2.25	99.3
1944	20,376	278	5,670,147	8.0	45,236,906	89,883,262	15.85	1.99	98.9

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

MILL EMPLOYMENT

A large percentage of the total employees in the cement industry is employed in the mills.

Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1940–44 (excluding Puerto Rico)

Year	Employment—cement mill only					Production			Percent of industry represented [1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1940	20,692	287	5,930,723	7.4	43,967,729	129,830,687	21.89	2.95	99.7
1941	22,205	311	6,904,905	7.3	50,616,860	163,567,931	23.69	3.23	99.7
1942	23,492	323	7,589,439	7.4	56,345,160	182,114,486	24.00	3.23	99.6
1943	19,958	308	6,156,775	7.6	47,004,631	132,445,838	21.51	2.82	99.3
1944	15,566	289	4,501,364	8.0	35,826,375	89,883,262	19.97	2.51	98.9

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

QUARRY AND CRUSHER EMPLOYMENT

The number of quarry and crusher employees is generally less than 20 percent of the total number of workers in the industry.

Quarry and crusher employees in the portland-cement industry, material (quarry rock and overburden) handled at quarries included in study, and average output of material per man in the United States, 1940–44 (excluding Puerto Rico)

Year	Employment—quarry and crusher only					Material handled—quarry rock and overburden				Percent of industry represented [1]
	Average number of men	Time employed				Short tons	Percent of overburden included	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours				Per shift	Per hour	
				Average per man per day	Total					
1940 [2]	4,394	244	1,070,881	7.6	8,171,104	33,804,500	2.6	31.57	4.14	82.6
1941 [2]	4,858	269	1,307,370	7.7	10,088,738	44,361,943	4.1	33.93	4.40	91.2
1942 [2]	5,090	280	1,423,290	7.8	11,089,206	50,959,664	10.4	35.80	4.60	90.9
1943 [3]	4,403	262	1,152,041	8.0	9,231,784	39,191,018	--------	34.02	4.25	92.1
1944 [3]	3,489	245	855,934	8.2	7,001,742	28,307,328	--------	33.07	4.04	91.6

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.
[2] Includes tonnage of quarry rock and overburden.
[3] Excludes overburden.

HOURS PER DAY

Employment data indicate a general trend toward a shorter working day.

Number of men employed in the portland-cement industry in the United States [1] and output per man-hour, 1942–44, classified according to hours of labor per day

Hours per day	1942			1943			1944		
	Men employed		Production per man-hour (barrels)	Men employed		Production per man-hour (barrels)	Men employed		Production per man-hour (barrels)
	Number	Percent of total		Number	Percent of total		Number	Percent of total	
Less than 6	1,395	4.7	2.77						
6 and less than 7	6,043	20.3	2.54	4,172	16.4	2.30	694	3.4	1.92
7 and less than 8	8,427	28.3	2.75	3,538	13.9	2.16	1,920	9.4	1.73
8 and less than 9	13,672	45.9	2.50	17,606	69.2	2.26	17,045	83.7	2.04
9 and less than 10	231	.8	2.60				494	2.4	1.42
10 and less than 11							92	.5	1.34
11 and less than 12				137	.5	2.16	131	.6	1.97
	29,768	100.0	2.59	25,453	100.0	2.25	20,376	100.0	1.99

[1] Exclusive of Puerto Rico.

EMPLOYMENT BY DISTRICTS

Employment by geographic areas is indicated in the following tables.

Employment in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1943–44, by districts (excluding Puerto Rico)

District	Employment					Production			Percent of industry represented[1]
	Average number of men	Time employed		Man-hours		Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Average per man per day	Total		Per shift	Per hour	
1943									
Eastern Pennsylvania and Maryland	4,330	276	1,195,258	7.5	8,963,677	18,318,790	15.33	2.04	100.0
New York and Maine	1,342	283	379,397	7.9	3,007,634	6,595,271	17.38	2.19	100.0
Ohio	1,455	305	444,216	8.0	3,554,034	6,412,566	14.44	1.80	100.0
Western Pennsylvania and West Virginia	1,434	309	442,641	7.6	3,385,826	5,013,348	11.33	1.48	100.0
Michigan	1,164	290	337,436	8.1	2,737,432	6,246,291	18.51	2.28	100.0
Illinois	867	301	261,209	7.1	1,852,566	4,682,139	17.92	2.53	100.0
Indiana, Kentucky, and Wisconsin	1,649	298	490,801	7.6	3,727,449	7,625,799	15.54	2.05	100.0
Alabama	1,099	320	351,812	7.7	2,704,798	7,560,462	21.49	2.80	100.0
Tennessee	900	292	262,365	7.7	2,008,422	4,774,089	18.20	2.38	100.0
Virginia, Georgia, Florida, and Louisiana	1,240	315	390,242	7.5	2,908,220	6,526,172	16.72	2.24	100.0
Iowa	1,072	276	295,416	7.7	2,288,439	4,569,899	15.47	2.00	100.0
Eastern Missouri, Minnesota, and South Dakota	1,333	296	395,197	7.4	2,942,938	5,262,184	13.32	1.79	100.0
Kansas	1,028	304	313,001	7.7	2,425,547	5,958,999	19.04	2.46	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	893	326	290,827	7.7	2,240,946	5,887,848	20.25	2.63	100.0
Texas	1,551	312	484,625	7.4	3,603,955	9,580,199	19.77	2.66	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	637	310	197,730	8.0	1,587,552	3,876,825	19.61	2.44	100.0
California	2,534	330	834,992	8.1	6,742,694	18,468,169	22.12	2.74	100.0
Oregon and Washington	925	280	259,211	7.9	2,055,313	5,086,788	19.62	2.47	100.0
	25,453	300	7,626,376	7.7	58,737,442	132,445,838	17.37	2.25	99.3
1944									
Eastern Pennsylvania and Maryland	3,224	237	764,958	7.9	6,077,909	11,845,505	15.49	1.95	100.0
New York and Maine	982	244	239,496	8.5	2,040,461	4,180,453	17.46	2.05	100.0
Ohio	1,007	281	283,023	8.2	2,320,006	3,911,337	13.82	1.69	100.0
Western Pennsylvania and West Virginia	1,102	318	350,792	7.8	2,720,074	2,699,134	7.69	.99	100.0
Michigan	973	270	262,287	8.0	2,104,898	5,218,620	19.90	2.48	100.0
Illinois	847	232	196,312	8.0	1,578,223	3,154,196	16.07	2.00	100.0
Indiana, Kentucky, and Wisconsin	1,152	315	363,175	8.2	2,976,357	4,809,428	13.24	1.62	100.0
Alabama	950	295	279,933	7.7	2,155,703	4,702,911	16.80	2.18	100.0
Tennessee	801	261	209,307	7.5	1,564,179	3,852,618	18.41	2.46	100.0
Virginia, Georgia, Florida, and Louisiana	1,006	292	293,249	8.1	2,373,827	4,625,911	15.77	1.95	100.0
Iowa	1,030	258	265,259	8.3	2,195,542	3,383,082	12.75	1.54	100.0
Eastern Missouri, Minnesota. and South Dakota	1,203	262	315,460	7.5	2,353,471	3,749,267	11.89	1.59	100.0
Kansas	768	239	183,567	8.1	1,477,940	2,818,777	15.36	1.91	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	809	321	259,972	7.9	2,058,574	3,043,493	11.71	1.48	100.0
Texas	1,215	286	347,969	7.9	2,764,105	6,136,052	17.63	2.22	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	590	294	173,333	8.0	1,388,683	2,698,558	15.57	1.94	100.0
California	1,922	343	659,430	8.0	5,292,839	14,650,600	22.22	2.77	100.0
Oregon and Washington	795	280	222,625	8.1	1,794,115	4,403,320	19.78	2.45	100.0
	20,376	278	5,670,147	8.0	45,236,906	89,883,262	15.85	1.99	98.9

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

Mill employees in the portland-cement industry, finished cement produced at mills included in study, and average output per man in the United States, 1943–44, by districts (excluding Puerto Rico)

District	Employment—cement mill only					Production			Percent of industry represented[1]
	Average number of men	Time employed				Finished portland cement (barrels)	Average per man (barrels)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1943									
Eastern Pennsylvania and Maryland	3,491	284	992,847	7.4	7,364,777	18,318,790	18.45	2.49	100.0
New York and Maine	1,120	296	331,812	7.8	2,603,282	6,595,271	19.88	2.53	100.0
Ohio	1,141	323	368,241	8.0	2,945,771	6,412,566	17.41	2.18	100.0
Western Pennsylvania and West Virginia	837	318	266,062	7.7	2,051,185	5,013,348	18.84	2.44	100.0
Michigan	998	303	302,081	8.1	2,448,723	6,246,291	20.68	2.55	100.0
Illinois	749	312	234,025	7.0	1,626,867	4,682,139	20.01	2.88	100.0
Indiana, Kentucky, and Wisconsin	1,512	301	455,485	7.6	3,447,867	7,625,799	16.74	2.21	100.0
Alabama	849	334	283,592	7.6	2,152,454	7,560,462	26.66	3.51	100.0
Tennessee	632	297	187,864	7.5	1,412,219	4,774,089	25.41	3.38	100.0
Virginia, Georgia, Florida, and Louisiana	934	324	303,030	7.2	2,190,459	6,526,172	21.54	2.98	100.0
Iowa	892	289	257,979	7.6	1,973,431	4,569,899	17.71	2.32	100.0
Eastern Missouri, Minnesota, and South Dakota	1,089	305	332,388	7.5	2,476,850	5,262,184	15.83	2.12	100.0
Kansas	738	308	227,048	7.6	1,735,635	5,958,999	26.25	3.43	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	708	330	233,972	7.6	1,785,573	5,887,848	25.16	3.30	100.0
Texas	1,212	318	384,971	7.4	2,855,338	9,580,199	24.89	3.36	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	512	313	160,502	8.0	1,287,778	3,876,825	24.15	3.01	100.0
California	1,904	337	641,435	8.0	5,130,731	18,468,169	28.79	3.60	100.0
Oregon and Washington	640	302	193,441	7.8	1,515,691	5,086,788	26.30	3.36	100.0
	19,958	308	6,156,775	7.6	47,004,631	132,445,838	21.51	2.82	99.3
1944									
Eastern Pennsylvania and Maryland	2,427	249	605,164	8.1	4,873,831	11,845,505	19.57	2.43	100.0
New York and Maine	700	267	186,926	8.6	1,609,328	4,180,453	22.36	2.60	100.0
Ohio	762	294	224,402	8.2	1,830,353	3,911,337	17.43	2.14	100.0
Western Pennsylvania and West Virginia	605	330	199,929	7.8	1,567,881	2,699,134	13.50	1.72	100.0
Michigan	858	274	234,697	8.0	1,877,573	5,218,620	22.24	2.78	100.0
Illinois	711	234	166,610	8.0	1,340,260	3,154,196	18.93	2.35	100.0
Indiana, Kentucky, and Wisconsin	939	328	307,965	8.0	2,453,643	4,809,428	15.62	1.96	100.0
Alabama	671	328	220,299	7.6	1,674,721	4,702,911	21.35	2.81	100.0
Tennessee	595	267	158,865	7.2	1,151,572	3,852,618	24.25	3.35	100.0
Virginia, Georgia, Florida, and Louisiana	732	301	220,336	8.1	1,784,332	4,625,911	20.99	2.59	100.0
Iowa	872	268	233,405	8.3	1,927,609	3,383,082	14.49	1.76	100.0
Eastern Missouri, Minnesota, and South Dakota	1,019	270	275,184	7.4	2,031,101	3,749,267	13.62	1.85	100.0
Kansas	516	245	126,285	8.1	1,021,623	2,818,777	22.32	2.76	100.0
Western Missouri, Nebraska, Oklahoma, and Arkansas	652	335	218,254	7.9	1,714,031	3,043,493	13.94	1.78	100.0
Texas	1,029	295	303,220	7.9	2,403,151	6,136,052	20.24	2.55	100.0
Colorado, Wyoming, Montana, Utah, and Idaho	479	303	144,990	8.0	1,159,922	2,698,558	18.61	2.33	100.0
California	1,421	360	511,284	8.0	4,090,576	14,650,600	28.65	3.58	100.0
Oregon and Washington	578	283	163,549	8.0	1,314,868	4,403,320	26.92	3.35	100.0
	15,566	289	4,501,364	8.0	35,826,375	89,883,262	19.97	2.51	98.9

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

Quarry and crusher employees in the portland-cement industry, material (quarry rock) handled at quarries included in study, and average output of material per man in the United States, 1943–44, by districts (excluding Puerto Rico)

District	Employment—quarry and crusher only					Material handled—quarry rock			Percent of industry represented[1]
	Average number of men	Time employed				Short tons	Average per man (short tons)		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1943									
Eastern Pennsylvania and Maryland	672	239	160, 281	8. 1	1, 295, 459	5, 556, 508	34. 67	4. 29	98. 7
New York and Maine	208	209	43, 443	8. 6	373, 388	1, 752, 220	40. 33	4. 69	100. 0
Ohio	274	243	66, 499	8. 0	532, 455	1, 942, 268	29. 21	3. 65	100. 0
Western Pennsylvania and West Virginia	448	290	130, 043	7. 4	965, 718	2, 577, 196	19. 82	2. 67	58. 8
Michigan	96	184	17, 695	8. 3	147, 400	599, 689	33. 89	4. 07	60. 9
Illinois	118	230	27, 184	8. 3	225, 699	1, 316, 848	48. 44	5. 83	100. 0
Indiana, Kentucky, and Wisconsin	132	254	33, 501	7. 9	265, 062	1, 166, 277	34. 81	4. 40	56. 2
Alabama	217	282	61, 253	8. 1	496, 609	2, 461, 185	40. 18	4. 96	100. 0
Tennessee	247	274	67, 782	8. 0	542, 449	1, 403, 393	20. 70	2. 59	100. 0
Virginia, Georgia, Florida, and Louisiana	269	282	75, 735	8. 3	631, 863	2, 250, 461	29. 71	3. 56	100. 0
Iowa	167	200	33, 459	8. 5	283, 184	1, 641, 655	49. 06	5. 80	100. 0
Eastern Missouri, Minnesota, and South Dakota	244	257	62, 809	7. 4	466, 088	1, 607, 361	25. 59	3. 45	85. 7
Kansas	199	273	54, 288	8. 1	440, 634	1, 699, 579	31. 31	3. 86	100. 0
Western Missouri, Nebraska, Oklahoma, and Arkansas	182	306	55, 760	8. 0	448, 305	1, 933, 999	34. 68	4. 31	100. 0
Texas	161	260	41, 919	8. 0	334, 158	2, 115, 493	50. 47	6. 33	93. 2
Colorado, Wyoming, Montana, Uah, and Idaho	98	301	29, 525	8. 0	235, 734	1, 195, 667	40. 50	5. 07	100. 0
California	450	314	141, 367	8. 1	1, 140, 437	6, 515, 519	46. 09	5. 71	98. 6
Oregon and Washington	221	224	49, 498	8. 2	407, 142	1, 455, 700	29. 41	3. 58	87. 2
	4, 403	262	1, 152, 041	8. 0	9, 231, 784	39, 191, 018	34. 02	4. 25	92. 1
1944									
Eastern Pennsylvania and Maryland	462	219	101, 089	7. 8	790, 098	3, 640, 332	36. 01	4. 61	99. 9
New York and Maine	142	186	26, 459	8. 5	224, 938	911, 108	34. 43	4. 05	93. 9
Ohio	204	244	49, 691	8. 1	401, 653	1, 283, 624	25. 83	3. 20	100. 0
Western Pennsylvania and West Virginia	333	281	93, 724	8. 0	748, 992	2, 044, 238	21. 81	2. 73	57. 0
Michigan	66	213	14, 077	8. 5	119, 227	610, 703	43. 38	5. 12	53. 7
Illinois	96	193	18, 564	8. 0	148, 862	826, 910	44. 54	5. 55	100. 0
Indiana, Kentucky, and Wisconsin	207	257	53, 198	9. 5	506, 616	1, 265, 647	23. 79	2. 50	59. 8
Alabama	188	254	47, 731	8. 1	385, 750	1, 805, 033	37. 82	4. 68	100. 0
Tennessee	193	239	46, 211	8. 2	378, 752	1, 108, 187	23. 98	2. 93	100. 0
Virginia, Georgia, Florida, and Louisiana	221	258	56, 915	8. 1	461, 518	1, 490, 229	26. 18	3. 23	100. 0
Iowa	143	204	29, 101	8. 4	245, 500	1, 345, 318	46. 23	5. 48	100. 0
Eastern Missouri, Minnesota, and South Dakota	176	215	37, 844	8. 0	302, 914	1, 303, 128	34. 43	4. 30	89. 1
Kansas	140	218	30, 499	8. 0	243, 439	862, 406	28. 28	3. 54	100. 0
Western Missouri, Nebraska, Oklahoma, and Arkansas	152	263	40, 038	8. 3	334, 019	951, 971	23. 78	2. 85	100. 0
Texas	138	233	32, 207	8. 1	262, 484	1, 371, 411	42. 58	5. 22	94. 2
Colorado, Wyoming, Montana, Utah, and Idaho	91	258	23, 497	8. 1	189, 990	881, 957	37. 53	4. 64	100. 0
California	365	291	106, 135	8. 1	856, 719	5, 298, 454	49. 92	6. 18	96. 9
Oregon and Washington	172	285	48, 954	8. 2	400, 271	1, 306, 672	26. 69	3. 26	87. 9
	3, 489	245	855, 934	8. 2	7, 001, 742	28, 307, 328	33. 07	4. 04	91. 6

[1] Calculated for each year by dividing quantity of finished cement produced at mills included in study by total production.

FOREIGN TRADE [2]

Imports.—As indicated in the following table, imports of cement have been very small during recent years. Imports by country of origin are listed in the second table following.

Hydraulic cement imported for consumption in the United States, 1941–45

Year	Barrels	Value	Year	Barrels	Value
1941	43,466	$59,048	1944	169	$418
1942	644	2,020	1945	323	700
1943	13,658	55,560			

Roman, portland, and other hydraulic cements imported for consumption in the United States, 1943–45, by countries [1]

Country	1943		1944		1945	
	Barrels	Value	Barrels	Value	Barrels	Value
Canada	13,652	$55,536	169	$417	320	$685
Chile					(2)	2
Dominican Republic					3	13
Egypt	5	10				
Guatemala			(2)	1		
Mexico	1	2				
	13,658	55,548	169	418	323	700

[1] Excludes "white, nonstaining, and other special cement."
[2] Less than 1 barrel

Exports.—Exports of nearly 6½ million barrels of cement in 1945 were far greater than the average of prewar years. The Latin-American countries are the principal foreign markets, particularly Mexico, Brazil, and Venezuela. Although the production capacity of the southern republics has increased greatly during recent years, it is apparent that market requirements are growing even more rapidly.

Hydraulic cement exported from the United States, 1941–45

Year	Barrels	Value	Percent of total shipments from mills
1941	2,556,234	$5,663,037	1.5
1942	1,100,826	2,707,217	.6
1943	1,731,956	4,654,862	1.3
1944	4,040,405	10,044,838	4.2
1945	6,476,333	15,570,610	6.0

[2] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Hydraulic cement exported from the United States, 1943–45, by countries

Country	1943		1944		1945	
	Barrels	Value	Barrels	Value	Barrels	Value
North America:						
Bermuda	4,767	$9,585	15,503	$33,352	15,361	$41,582
Canada	24,579	93,867	22,064	93,863	41,151	152,365
Central America:						
British Honduras	3,214	6,600	6,282	14,057	7,519	16,401
Costa Rica	127,658	305,120	59,412	131,701	163,162	348,183
El Salvador	85,965	211,123	41,983	104,669	110,137	242,483
Guatemala	8,906	28,319	2,408	11,686	6,051	16,168
Honduras	32,698	82,274	37,128	91,197	56,699	131,185
Nicaragua	13,923	30,192	3,203	9,744	23,749	51,075
Panama:						
Canal Zone	35,823	78,268	75,185	155,950	87,215	182,616
Republic of	139,026	319,493	249,371	577,185	380,549	836,466
Mexico	347,582	842,241	560,554	1,461,926	1,012,337	2,587,303
Newfoundland and Labrador	313	902	75	314	2,259	4,951
West Indies:						
British:						
Bahamas	39,751	86,253	19,635	50,560	17,855	45,270
Jamaica	31	128	3,107	7,349	16,471	36,249
Leeward and Windward Islands	3,347	6,513	21,838	49,837	18,269	42,112
Trinidad and Tobago	15,342	31,626	15,840	36,681	28,988	62,567
Other	9,326	27,444			3,657	7,814
Cuba	66,499	239,721	387,043	842,143	450,969	1,016,204
Curaçao (N. W. I.)	73,227	179,503	82,048	181,252	116,499	257,394
Dominican Republic	118,737	305,111	233,750	550,839	229,328	497,232
French	9,906	28,037	64,376	149,874	67,430	140,082
Haiti	48,011	117,990	31,222	73,244	62,491	139,658
Other North America	260	621	2,537	7,286	14,304	30,049
	1,208,891	3,030,931	1,934,564	4,634,709	2,932,450	6,885,409
South America:						
Argentina	11,267	67,245	4,491	26,890	5,786	32,403
Bolivia	7,776	24,899	95,615	222,847	417	2,116
Brazil	85,594	292,955	505,554	1,421,247	1,234,255	3,074,391
Chile	5,545	38,809	35,446	111,946	199,770	440,097
Colombia	23,777	151,185	223,866	527,138	185,187	531,599
Ecuador	2,613	13,972	10,498	32,398	8,521	21,663
Paraguay	2,480	10,390	775	3,152	2,165	6,471
Peru	4,501	27,266	20,868	54,913	54,937	141,092
Surinam	30,754	75,730	29,031	61,213	18,125	40,918
Uruguay	2,863	16,096	2,278	12,251	6,158	30,536
Venezuela	319,897	821,467	1,075,596	2,676,180	1,444,699	3,441,990
Other South America	1,795	4,427	21,360	47,844	4,697	10,691
	498,862	1,544,441	2,025,378	5,198,019	3,164,717	7,773,967
Europe:						
France					157,181	352,998
Norway					8,843	18,215
Portugal	500	2,601	253	1,412	1,082	6,478
Other Europe			104	152	1,140	9,410
	500	2,601	357	1,564	168,246	387,101
Asia:						
Arabia Peninsular States	250	830	19,793	53,747	6,934	21,166
French Indochina					23,400	53,352
Iran	638	12,019	42,560	102,518	9	159
Netherlands Indies					6,681	14,404
Palestine	79	1,009	122	1,675	9	83
Philippine Islands					90,048	211,414
State of Bahrein	777	7,405	4,480	16,886	274	1,453
Other Asia	1	109	241	852	14,949	38,157
	1,745	21,372	67,196	175,678	142,304	340,188
Africa:						
Egypt	3,437	5,820	200	1,100		
Liberia	16,655	35,027	8,487	18,257	4,788	15,807
Mozambique					14,507	40,005
Portuguese Guinea and Angola			2,514	5,580	44,468	99,035
Union of South Africa	384	1,940	292	1,760	1,439	9,209
Other Africa	1,441	12,317	827	6,944	2,702	13,181
	21,917	55,104	12,320	33,641	67,904	177,237

Hydraulic cement exported from the United States, 1943–45, by countries—Continued

Country	1943		1944		1945	
	Barrels	Value	Barrels	Value	Barrels	Value
Oceania:						
Australia					587	$5,500
French Oceania	40	$352	590	$1,227		
New Zealand	1	61			120	1,184
Other Oceania					5	24
	41	413	590	1,227	712	6,708
	1,731,956	4,654,862	4,040,405	10,044,838	6,476,333	15,570,610

Shipments of hydraulic cement to noncontiguous Territories of the United States, 1943–45, are indicated in the following table.

Domestic hydraulic cement shipped to noncontiguous Territories of the United States, 1943–45

Territory	1943		1944		1945	
	Barrels	Value	Barrels	Value	Barrels	Value
Alaska	52,422	$139,749	27,832	$79,589	40,599	$113,430
American Samoa			27	59	83	232
Hawaii	372,958	931,896	111,878	239,079	208,394	405,208
Puerto Rico	1,841	10,619	2,583	15,123	5,271	28,661
Virgin Islands	17,053	81,065	20,774	69,565	19,082	48,663

WORLD PRODUCTION

Insofar as figures are available, a general upward trend is indicated throughout the world in the production of cement in 1945.

World production of hydraulic cements, 1939–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country	1939	1940	1941	1942	1943	1944	1945
North America:							
Canada	909,875	1,200,143	1,328,587	1,448,818	1,159,286	1,141,595	1,330,116
Cuba	(2)	(2)	154,618	165,189	169,609	173,750	180,166
Guatemala	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Mexico	409,784	484,992	537,464	588,476	578,253	(2)	(2)
Nicaragua				620	10,627	(2)	(2)
United States	21,267,269	22,640,675	28,465,880	31,609,981	23,067,914	15,716,820	17,533,628
South America:							
Argentina	1,127,608	1,082,279	1,168,281	1,076,858	957,076	(2)	(2)
Bolivia	(2)	24,285	(2)	22,579	22,675	(2)	(2)
Brazil	697,793	743,634	767,506	752,839	747,409	809,908	[3] 815,000
Chile	340,758	385,091	359,720	364,584	374,747	362,877	(2)
Colombia	167,000	187,619	210,912	207,793	258,578	281,626	300,981
Ecuador	14,249	16,481	17,014	19,802	27,860	34,607	[3] 38,170
Peru	119,986	124,480	167,872	188,882	208,599	248,537	[3] 255,000
Uruguay	173,500	167,880	179,066	(2)	(2)	165,990	185,290
Venezuela	38,399	87,068	115,415	121,833	111,721	119,670	(2)

See footnotes at end of table.

World production of hydraulic cements, 1939–45, by countries, in metric tons[1]*—Continued*

Country	1939	1940	1941	1942	1943	1944	1945
Europe:							
Albania	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Belgium	2,551,756	[4] 212,550	[4] 630,580	[4] 510,670	[4] 459,520	[4] 141,750	647,200
Bulgaria	[3] 180,000	(2)	(2)	(2)	(2)	(2)	(2)
Czechoslovakia [5]	276,000	214,000	300,000	320,000	350,000	(2)	(2)
Denmark	696,000	441,000	(2)	(2)	(2)	(2)	(2)
Eire	261,000	272,000	294,000	202,000	251,980	222,515	(2)
Estonia	77,000	(2)	(2)	(2)	(2)	(2)	(2)
Finland	563,000	301,000	307,000	179,000	(2)	(2)	(2)
France	(2)	(2)	3,402,000	2,462,000	2,934,000	1,467,000	1,500,000
Germany [6]	13,957,000	10,746,000	11,349,000	7,287,000	9,073,000	(2)	(2)
Austria	742,000	819,000	842,000	682,000	773,000	(2)	(2)
Greece	343,000	190,000	63,000	30,000	(2)	(2)	(2)
Hungary	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Italy	5,111,610	4,802,124	2,793,548	(2)	(2)	(2)	(2)
Latvia	164,601	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands	541,000	(2)	(2)	(2)	(2)	(2)	(2)
Norway	390,000	337,849	312,830	373,648	(2)	(2)	(2)
Poland	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Portugal	297,000	273,000	272,000	[7] 186,967	246,799	[3] 252,000	[7] 198,530
Rumania	531,000	400,000	368,000	357,000	493,000	(2)	(2)
Spain	1,194,481	1,557,878	1,639,923	1,646,280	1,701,520	1,843,037	1,544,448
Sweden	1,184,991	700,749	645,023	823,880	935,000	(2)	(2)
Switzerland	(2)	650,000	711,000	439,000	367,000	430,000	415,000
U. S. S. R	5,700,000	5,800,000	(2)	(2)	(2)	(2)	(2)
United Kingdom	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Yugoslavia	663,000	(2)	(2)	(2)	[3] 750,000	(2)	(2)
Asia:							
China	[8] 540,000	652,500	(2)	(2)	(2)	(2)	(2)
Manchuria	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Hong Kong	[3] 110,000	(2)	(2)	(2)	(2)	(2)	(2)
India, British	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Indochina	305,800	278,500	(2)	(2)	(2)	(2)	(2)
Iran	(2)	69,000	55,000	55,000	35,000	38,000	(2)
Japan and colonies	5,074,000	[3] 4,250,000	(2)	(2)	(2)	(2)	(2)
Korea (Chosen)	[3] 1,200,000	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	[3] 170,000	(2)	(2)	(2)	(2)	(2)	(2)
Palestine	112,350	148,487	114,841	216,577	166,804	176,499	147,237
Philippine Islands	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Siam (Thailand)	[9] 92,000	[9] 116,864	(2)	(2)	(2)	(2)	(2)
Syria and Lebanon	227,285	91,653	82,400	214,800	151,900	155,000	190,000
Turkey	283,624	267,054	272,919	210,855	151,472	285,350	[3] 300,000
Africa:							
Algeria	(2)	(2)	(2)	(2)	(2)	95,000	(2)
Belgian Congo	35,000	24,700	42,586	64,340	69,221	84,776	(2)
Egypt	371,941	360,832	420,107	420,980	322,859	423,902	(2)
Eritrea	30,000	15,000	9,000	25,000	27,500	38,000	(2)
Morocco, French	(2)	(2)	(2)	(2)	[3] 140,000	(2)	(2)
Mozambique	27,618	27,893	27,260	24,941	30,647	27,932	(2)
Tunisia	66,500	61,800	57,200	56,300	17,812	58,428	(2)
Union of South Africa	948,664	831,018	878,000	[3] 948,000	[3] 915,000	(2)	(2)
Oceania:							
Australia: [10]							
New South Wales	409,896	381,697	390,171	337,947	351,887	313,976	(2)
Tasmania	92,190	93,921	85,729	53,324	43,530	(2)	42,782
Victoria	180,349	228,388	215,301	172,017	(2)	127,971	133,407
New Zealand [11]	235,000	218,000	(2)	(2)	[3] 217,000	(2)	(2)
	[3] 93,000,000	[3] 81,000,000	[3] 77,000,000	[3] 72,000,000	[3] 81,000,000	(2)	(2)

[1] Data cover all hydraulic cements.
[2] Data not available; estimate included in total, except for 1944 and 1945.
[3] Estimate.
[4] Excludes portland cement data, which are not yet available.
[5] Slovakia only.
[6] Includes Sudetenland.
[7] January to September, inclusive.
[8] Shipments.
[9] Year ended March 31 of year stated.
[10] Cement is also produced in Queensland and South Australia, but data are not released.
[11] Year ended June 30 of year stated.

STONE

By Oliver Bowles and Nan C. Jensen

SUMMARY OUTLINE

GENERAL CONDITIONS

Sales of crushed and dimension stone combined (153,405,210 tons) were 1 percent less in 1945 than in 1944 and 22 percent less than the all-time high record of 1942. The total value of sales ($179,307,902) was, however, 2 percent greater than in 1944. Sales of crushed and broken stone declined 2 percent, although the total value of sales was a little higher than in 1944. Dimension stone, on the other hand, experienced a strong recovery, the quantity sold gaining 71 percent and the value 20 percent compared with 1944. However, the industry was still far below its prewar level. The lower average unit values in 1945 of both monumental stone and cut stone for building purposes compared with 1944 is noteworthy.

This chapter follows the general plan introduced in 1938, whereby crushed stone and dimension stone are considered separately, except in the introductory general tables.

The tables of this report give the quantities sold or used by producers and the values f. o. b. quarries and mills. Stone quarried and used by producers is considered as sold and is included in the statistics of sales. The data, however, do not include stone made into abrasives (such as grindstones) or that used in making lime and cement. These materials are reported in terms of finished products in the Abrasive Materials, Lime, and Cement chapters of this volume. The following tables show the total sales of stone by kinds, uses, and States.

Stone sold or used by producers in the United States, 1941–45, by kinds

[Quantities approximate]

Year	Granite		Basalt and related rocks (trap rock)		Marble		Limestone	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	14, 298, 750	$24, 968, 489	17, 936, 950	$18, 641, 852	176, 460	$4, 785, 710	133, 163, 600	$127, 585, 118
1942	14, 064, 780	23, 794, 514	17, 626, 660	21, 005, 943	169, 500	3, 910, 203	142, 487, 600	138, 578, 027
1943	9, 240, 280	18, 217, 064	14, 385, 260	17, 699, 907	168, 790	3, 610, 035	128, 980, 270	127, 296, 872
1944	7, 395, 390	17, 200, 247	14, 043, 290	17, 158, 774	152, 710	4, 374, 722	115, 506, 130	118, 550, 317
1945	7, 740, 030	17, 052, 764	14, 910, 540	17, 532, 775	171, 230	5, 284, 827	112, 574, 420	121, 441, 509

Year	Sandstone		Other stone [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	7, 592, 820	$10, 768, 748	9, 939, 380	$8, 587, 509	183, 107, 960	$195, 337, 426
1942	6, 700, 920	8, 620, 453	14, 835, 030	9, 092, 879	195, 884, 490	205, 002, 019
1943	7, 408, 230	11, 071, 258	11, 160, 420	6, 424, 898	171, 343, 250	184, 320, 034
1944	6, 426, 670	10, 985, 211	12, 055, 390	7, 372, 886	155, 579, 580	175, 642, 157
1945	4, 386, 990	8, 712, 045	13, 622, 000	9, 283, 982	153, 405, 210	179, 307, 902

[1] Includes mica schist, conglomerate, argillite, various light-color volcanic rocks, serpentine not used as marble, soapstone sold as dimension stone, and such other stone as cannot properly be classed in any main group.

Stone sold or used by producers in the United States, 1944–45, by uses

Use	1944		1945	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone:				
Rough construction short tons	106, 900	$696, 988	155, 750	$926, 402
Cut stone, slabs, and mill blocks cubic feet	1, 224, 780	2, 072, 005	3, 038, 120	4, 558, 609
Approximate equivalent in short tons	92, 950		225, 870	
Rubble short tons	135, 060	230, 620	390, 430	548, 645
Monumental stone cubic feet	2, 940, 150	11, 396, 526	3, 038, 870	11, 360, 627
Approximate equivalent in short tons	242, 750		250, 850	
Paving blocks number	655, 360	45, 417	212, 570	22, 336
Approximate equivalent in short tons	3, 800		1, 560	
Curbing cubic feet	207, 060	194, 272	158, 260	203, 797
Approximate equivalent in short tons	16, 580		12, 760	
Flagging cubic feet	263, 590	218, 988	268, 480	228, 222
Approximate equivalent in short tons	20, 580		21, 470	
Total dimension stone (quantities approximate, in short tons)	618, 620	14, 854, 816	1, 058, 690	17, 848, 638
Crushed and broken stone:				
Riprap short tons	4, 011, 210	4, 947, 843	4, 801, 170	5, 589, 584
Crushed stone do	83, 080, 550	78, 701, 175	85, 373, 260	80, 429, 619
Furnace flux (limestone) do	31, 080, 330	25, 130, 113	27, 639, 520	22, 076, 393
Refractory stone [1] do	2, 313, 640	3, 922, 238	2, 526, 650	4, 545, 339
Agricultural (limestone) do	18, 941, 220	25, 316, 219	17, 395, 570	25, 892, 317
Other uses do	15, 534, 010	22, 769, 753	14, 610, 350	22, 926, 012
Total crushed and broken stone do	154, 960, 960	160, 787, 341	152, 346, 520	161, 459, 264
Grand total (quantities approximate, in short tons)	155, 579, 580	175, 642, 157	153, 405, 210	179, 307, 902

[1] Ganister (sandstone), mica schist, soapstone, and dolomite.

Stone sold or used by noncommercial producers in the United States, 1944–45, by uses

[Included in total production]

Use	1944		1945	
	Short tons	Value	Short tons	Value
Building stone	19,610	$25,362	59,490	$72,634
Rubble	32,680	49,968	209,610	219,972
Flagging	2,170	7,650		
Riprap	740,900	820,831	1,443,830	1,866,197
Crushed stone	7,979,540	8,429,328	4,760,970	5,317,471
Agricultural (limestone)	264,770	342,562	326,560	479,461
Other uses	442,080	577,877	468,580	812,889
	9,481,750	10,253,578	7,269,040	8,768,624

Stone sold or used by producers in the United States, 1944–45, by States

State	1944		1945	
	Short tons (approximate)	Value	Short tons (approximate)	Value
Alabama	2,542,210	$3,385,801	2,238,740	$3,326,753
Alaska	(1)	(1)	(1)	(1)
Arizona	(2) 116,670	(2) 105,662	404,170	376,200
Arkansas	730,310	790,271	(2) 932,320	(2) 926,763
California	(2) 9,909,680	(2) 9,987,362	9,636,810	8,554,461
Colorado	680,620	568,095	671,620	923,797
Connecticut	1,029,790	1,213,543	817,670	1,166,288
Delaware	9,970	14,958		
Florida	2,730,020	2,600,462	(2) 2,617,180	(2) 3,024,465
Georgia	1,773,150	5,037,596	(2) 1,514,710	(2) 4,799,320
Hawaii	(2) 1,960,730	(2) 2,891,304	1,639,820	2,433,566
Idaho	(2) 323,000	(2) 413,805	247,140	293,980
Illinois	10,680,640	10,700,140	10,950,940	11,384,625
Indiana	4,102,140	4,562,399	4,187,110	6,293,019
Iowa	(2) 3,563,020	(2) 4,175,005	(2) 4,026,460	(2) 5,306,299
Kansas	2,121,020	2,069,738	(2) 3,666,000	(2) 2,847,200
Kentucky	3,566,920	3,472,065	(2) 3,470,770	(2) 3,740,716
Louisiana	1,079,150	824,681	1,000,040	756,341
Maine	(2) 125,840	(2) 332,736	(2) 112,920	(2) 382,414
Maryland	(2) 1,272,480	(2) 1,756,318	(2) 1,242,930	(2) 1,851,828
Massachusetts	1,284,070	2,287,050	1,283,310	2,393,390
Michigan	15,789,320	8,709,353	(2) 15,493,790	(2) 9,027,267
Minnesota	(2) 1,316,790	(2) 2,245,814	1,173,800	1,962,394
Mississippi	(1)	(1)	(1)	(1)
Missouri	4,856,540	5,312,384	(2) 5,314,160	(2) 6,055,747
Montana	(2) 232,090	(2) 229,160	646,850	563,374
Nebraska	169,720	483,563	297,750	622,671
Nevada	90,590	138,954	104,180	151,673
New Hampshire	910	48,000	3,760	93,089
New Jersey	2,211,690	3,321,978	(2) 2,261,750	(2) 3,498,182
New Mexico	(2) 609,240	(2) 334,357	361,700	173,120
New York	7,454,160	8,073,778	7,900,560	9,133,781
North Carolina	4,659,540	5,975,951	(2) 2,297,670	(2) 2,965,458
Ohio	(2) 15,048,230	(2) 15,292,705	(2) 13,279,800	(2) 13,966,710
Oklahoma	4,563,270	1,799,765	3,894,720	1,572,772
Oregon	1,947,230	2,378,142	(2) 1,498,160	(2) 1,898,073
Pennsylvania	(2) 18,175,280	(2) 22,516,282	(2) 17,708,390	(2) 22,266,706
Puerto Rico	(2) 175,330	(2) 200,619	271,150	342,606
Rhode Island	(2) 19,790	(2) 213,351	(2) 11,280	(2) 219,263
South Carolina	1,195,900	1,717,295	(2) 1,380,800	(2) 2,041,202
South Dakota	255,530	1,412,141	(2) 303,500	(2) 1,605,904
Tennessee	(2) 6,063,420	(2) 7,776,775	4,772,720	6,318,915
Texas	(2) 2,742,120	(2) 2,455,791	2,798,580	2,726,659
Utah	(2) 363,880	(2) 363,285	(2) 215,400	(2) 318,254
Vermont	168,560	4,396,576	173,120	4,538,557
Virginia	5,539,760	6,360,769	5,445,900	6,689,809
Washington	(2) 2,538,690	(2) 2,756,332	(2) 3,741,250	(2) 3,773,096
West Virginia	3,455,450	3,718,735	3,670,700	3,989,534
Wisconsin	(2) 4,658,620	(2) 7,741,499	4,764,180	8,442,921
Wyoming	396,660	383,463	1,551,220	1,321,415
Undistributed	1,279,840	2,096,349	1,407,710	2,247,325
	155,579,580	175,642,157	153,405,210	179,307,902

(1) Included under "Undistributed."

(2) To avoid disclosing confidential information, certain State totals are incomplete, the figures not included being combined under "Undistributed."

DIMENSION STONE

Dimension stone includes blocks or slabs of natural stone that are cut or trimmed to definite shapes and sizes. Materials classed as crushed and broken stone, on the other hand, comprise irregular fragments or grains sized chiefly by screening or air separation. Crushed and broken stone is covered in a later section of this chapter.

Dimension-stone producers may be divided into three main groups upon the basis of plant operation. The first group quarries stone and sells it as rough blocks or slabs; the second quarries stone and also manufactures it into finished products; and the third buys sawed slabs or rough blocks of stone and manufactures them into finished products but does not operate quarries. The Bureau of Mines statistical canvass covers the first and second but not the third group. Bureau of Mines statistics are compiled from reports of quantities and values of original sales, hence they include some material sold as rough blocks and some sold as finished products.

Total sales of dimension stone in 1945 increased 66 percent in quantity and 20 percent in value compared with 1944. These over-all figures include slate, but detailed statistics of this branch of the industry are given in the separate chapter on Slate.

The following table presents salient statistics for 1944 and 1945.

Dimension stone sold or used by producers in the United States, 1944–45, by kinds and uses

Kind and use	1944	1945	
		Total	Percent of change
Granite:			
Building stone:			
Rough construction ... short tons	8,790	15,220	+73
Value	$36,636	$56,314	+54
Average per ton	$4.17	$3.70	−11
Cut stone, slabs, and mill blocks ... cubic feet	104,650	151,250	+45
Value	$235,228	$328,366	+40
Average per cubic foot	$2.25	$2.17	−4
Rubble ... short tons	44,000	108,880	+147
Value	$88,994	$192,107	+116
Monumental stone ... cubic feet	2,507,780	2,600,760	+4
Value	$8,594,682	$8,228,343	−4
Average per cubic foot	$3.43	$3.16	−8
Paving blocks ... number	649,360	212,570	−67
Value	$45,017	$22,336	−50
Curbing ... cubic feet	153,060	119,270	−22
Value	$128,283	$153,819	+20
Total:			
Quantity ... approximate short tons	283,780	361,650	+27
Value	$9,128,840	$8,981,285	−2
Basalt and related rocks (trap rock):			
Building stone:			
Rough construction ... short tons	5,320	7,470	+40
Value	$12,183	$19,702	+62
Average per ton	$2.29	$2.64	+15
Rubble ... short tons	13,140	196,050	+1,392
Value	$4,991	$210,693	+4,121
Total:			
Quantity ... short tons	18,460	203,520	+1,002
Value	$17,174	$230,395	+1,242

Dimension stone sold or used by producers in the United States, 1944–45, by kinds and uses—Continued

Kind and use	1944	1945 Total	1945 Percent of change
Marble:			
Building stone (cut stone, slabs, and mill blocks)..cubic feet..	178,170	265,500	+49
Value	$1,065,638	$1,573,148	+48
Average per cubic foot	$5.98	$5.93	−1
Monumental stone..cubic feet..	432,370	438,110	+1
Value	$2,801,844	$3,132,284	+12
Average per cubic foot	$6.48	$7.15	+10
Total:			
Quantity..approximate short tons..	51,900	59,690	+15
Value	$3,867,482	$4,705,432	+22
Limestone:			
Building stone:			
Rough construction..short tons..	47,360	92,090	+94
Value	$58,076	$138,825	+139
Average per ton	$1.23	$1.51	+23
Cut stone, slabs, and mill blocks..cubic feet..	730,570	2,298,140	+215
Value	$481,631	$2,267,501	+371
Average per cubic foot	$0.66	$0.99	+50
Rubble..short tons..	54,200	69,780	+29
Value	$60,833	$73,413	+21
Flagging..cubic feet..	76,250	65,060	−15
Value	$22,789	$25,272	+11
Total:			
Quantity..approximate short tons..	161,640	334,480	+107
Value	$623,329	$2,505,011	+302
Sandstone:			
Building stone:			
Rough construction..short tons..	22,440	9,220	−59
Value	$51,874	$35,276	−32
Average per ton	$2.31	$3.83	+66
Cut stone, slabs, and mill blocks..cubic feet..	211,390	323,230	+53
Value	$289,508	$389,594	+35
Average per cubic foot	$1.37	$1.21	−12
Rubble..short tons..	18,970	13,150	−31
Value	$62,750	$65,051	+4
Paving blocks..number..	6,000		−100
Value	$400		−100
Curbing..cubic feet..	54,000	38,990	−28
Value	$65,989	$49,978	−24
Flagging..cubic feet..	175,500	194,130	+11
Value	$188,799	$197,051	+4
Total:			
Quantity..approximate short tons..	74,160	64,240	−13
Value	$659,320	$736,950	+12
Miscellaneous stone: [1]			
Building stone..cubic feet..	273,070	373,530	+37
Value	$538,219	$676,285	+26
Average per cubic foot	$1.97	$1.81	−8
Rubble..short tons..	4,750	2,570	−46
Value	$13,052	$7,381	−43
Flagging..cubic feet..	11,840	9,290	−22
Value	$7,400	$5,899	−20
Total:			
Quantity..approximate short tons..	28,680	35,110	+22
Value	$558,671	$689,565	+23
Total dimension stone, excluding slate:			
Quantity..approximate short tons..	618,620	1,058,690	+71
Value	$14,854,816	$17,848,638	+20
Slate as dimension stone [2]..approximate short tons..	60,950	69,660	+14
Value	$1,720,958	$1,971,740	+15
Total dimension stone, including slate:			
Quantity..approximate short tons..	679,570	1,128,350	+66
Value	$16,575,774	$19,820,378	+20

[1] Includes soapstone, mica schist, volcanic rocks, argillite, and other varieties that cannot be classified in the principal groups.
[2] Details of production, by uses, are given in the chapter on Slate in this volume.

BUILDING STONE

Stone is the most ancient building material used in more or less permanent structures of which we have historic records. Natural caves protected by overhanging rock probably furnished the earliest human shelter. Stone has always occupied an important place in the construction of historic buildings and monuments, but its use has been greatly limited under conditions prevailing throughout the world during recent years. In 1945, however, sales of building stone were almost double both in quantity and value those of the all-time low of 1944.

The following table gives the quantity and value of each kind of building stone sold in 1945.

Building stone sold or used by producers in the United States in 1945, by kinds

Kind	Rough: Construction: Cubic feet	Rough: Construction: Value	Rough: Architectural: Cubic feet	Rough: Architectural: Value
Granite	183,890	$56,314	61,120	$71,898
Basalt	87,890	19,702		
Marble			84,130	174,971
Limestone	1,113,590	138,825	1,123,290	578,035
Sandstone	116,580	35,276	52,640	31,818
Miscellaneous	373,530	676,285		
	1,875,480	926,402	1,321,180	856,722

Kind	Finished: Sawed [1]: Cubic feet	Finished: Sawed [1]: Value	Finished: Cut [1]: Cubic feet	Finished: Cut [1]: Value	Total: Cubic feet	Total: Value
Granite	40,900	$79,992	49,230	$176,476	335,140	$384,680
Basalt					87,890	19,702
Marble	54,300	203,061	127,070	1,195,116	265,500	1,573,148
Limestone	748,480	585,288	426,370	1,104,178	3,411,730	2,406,326
Sandstone	[2] 270,590	[2] 357,776	(2)	(2)	439,810	424,870
Miscellaneous					373,530	676,285
	[2] 1,114,270	[2] 1,226,117	[2] 602,670	[2] 2,475,770	4,913,600	5,485,011

[1] For granite, sawed stone corresponds to dressed stone for construction work (walls, foundations, bridges) and cut stone to architectural stone for high-class buildings.
[2] A small quantity of cut sandstone is included under sawed stone.

GRANITE

Sales of granite in the form of blocks and slabs gained 27 percent in quantity but declined 2 percent in value in 1945 compared with 1944. Unit prices were lower in all but one of the important categories—that of rough architectural stone. The unit values of paving blocks and curbing were also higher, but those products have become a quite unimportant branch of the industry. The greatest gains were in the building-stone branch of the industry, rough construction stone sales gaining 73 percent and cut stone 45 percent in quantity compared with 1944. Monumental stone gained 4 percent in quantity but declined 4 percent in value. Paving block and curbing sales declined greatly from the low levels of 1944. Details by States are indicated in the following table.

Granite (dimension stone) sold or used by producers in the United States in 1945, by States and uses

State	Active plants	Building: Rough: Construction: Short tons	Building: Rough: Construction: Value	Building: Rough: Architectural: Cubic feet	Building: Rough: Architectural: Value	Building: Dressed: Cubic feet	Building: Dressed: Value	Building: Rubble: Short tons	Building: Rubble: Value	Monumental: Rough: Cubic feet	Monumental: Rough: Value	Monumental: Dressed: Cubic feet	Monumental: Dressed: Value	Paving blocks: Number	Paving blocks: Value	Curbing: Cubic feet	Curbing: Value	Total: Short tons (approximate)	Total: Value
Alaska	1							(1)	(1)									(1)	(1)
California	13	440	$1,390			(1)	(1)	(1)	(1)	28,060	$93,004	15,630	$101,906					26,320	$266,850
Colorado	5									3,000	6,405							250	6,405
Connecticut	4			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)					3,010	75,985
Georgia	14	140	135	(1)	(1)			(1)	(1)	574,720	811,896	115,080	333,789			(1)	(1)	69,600	1,191,836
Maine	4	1,780	3,804	17,040	$15,316	7,720	$46,568	1,320	$2,952	8,830	12,669	6,000	40,000			750	$1,500	6,450	122,809
Maryland	3	1,320	8,375					17,110	33,056							1,030	993	18,510	42,424
Massachusetts	3	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	15,930	428,282
Minnesota	15			10,110	10,228					244,520	359,242	43,230	240,322					24,720	609,792
Missouri	2	390	1,381							15,870	31,791							1,720	33,172
Montana	3									(1)	(1)	(1)	(1)					110	6,240
New Hampshire	3					5,910	32,909			(1)	(1)	(1)	(1)			1,800	2,484	1,480	90,150
New York	3	(1)	(1)	8,000	10,000			970	3,000					(1)	(1)	(1)	(1)	8,020	44,005
North Carolina	6	190	950			(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	13,990	312,794
Oklahoma	7							550	762	21,590	52,734	16,060	147,286					3,660	200,782
Oregon	1									300	900							20	900
Pennsylvania	7	3,070	7,427	(1)	(1)	(1)	(1)	3,110	2,309	(1)	(1)	(1)	(1)	3,650	$182			9,630	169,029
Puerto Rico	1	(1)	(1)															(1)	(1)
Rhode Island	2									61,790	208,640							5,040	208,640
South Carolina	3							(1)	(1)	(1)	(1)			23,800	1,676	(1)	(1)	22,030	583,573
South Dakota	7			10,230	5,319					92,960	104,098	118,710	1,080,290					17,970	1,189,707
Texas	3									22,100	65,400	5,800	58,000					2,300	123,400
Vermont	6									723,650	2,325,996							58,620	2,325,996
Virginia	2							(1)	(1)	(1)	(1)							(1)	(1)
Washington	3							(1)	(1)			(1)	(1)					11,410	22,657
Wisconsin	11			(1)	(1)					11,970	45,998	63,260	784,866	(1)	(1)			7,380	858,531
Undistributed		7,890	32,852	15,740	31,035	76,500	176,991	85,820	150,028	334,090	768,657	73,540	554,454	185,120	20,478	115,690	148,842	33,480	67,326
	132	15,220	56,314	61,120	71,898	90,130	256,468	108,880	192,107	2,143,450	4,887,430	457,310	3,340,913	212,570	22,336	119,270	153,819	361,650	8,981,285
Average unit value			$3.70		$1.18		$2.85		$1.76		$2.28		$7.31		$0.11		$1.29		$24.83
Short tons (approximate)		(2)		5,060		7,450				175,990		37,650		1,560		9,840			

1 Included under "Undistributed."

2 183,890 cubic feet (approximate).

The following tables show sales of monumental granite in the Barre district, Vermont.

Monumental granite sold by quarrymen in the Barre district, Vermont, 1941–45 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1941	764,280	$2,431,152	1944	733,500	$2,553,681
1942	612,220	2,035,327	1945	713,050	2,308,506
1943	635,350	2,267,777			

[1] Barre granite is sold also for construction and crushed stone.

Estimated output of monumental granite in the Barre district, Vermont, 1943–45 [1]

	1943	1944	1945
Total quarry output, rough stock ... cubic feet	578,148	613,308	716,089
Shipped out of Barre district in rough ... do	115,630	122,661	143,217
Manufactured in Barre district ... do	462,518	490,647	572,872
Light stock consumed in district ... do	289,074	383,319	477,393
Dark stock consumed in district ... do	173,444	229,989	238,696
Number of cutters in district	1,204	1,200	1,318
Average daily wage	$9.50	$10.00	$10.50
Average number of days worked	222	244	250
Total pay roll for year	$2,539,236	$2,928,000	$3,459,750
Estimated overhead	1,269,618	1,464,000	1,729,875
Estimated value of light stock	1,318,900	1,494,934	1,862,833
Estimated value of dark stock	1,008,146	1,069,449	1,109,936
Estimated polishing cost	365,794	129,347	1,441,128
Estimated sawing cost	121,931	388,038	1,127,839
Total value of granite	6,623,625	7,473,768	10,731,361

[1] Through the kindness of the Granite Manufacturers' Association, Barre, figures covering the entire granite industry of the Barre district are given in this table to supplement figures of sales reported by quarrymen.

BASALT AND RELATED ROCKS (TRAP ROCK)

Basalt and related rocks are used only in a small way as building stone. Sales in 1945 were much higher than in 1944, particularly of the products classed as rubble, the crudest form of building stone. Basalt and related rocks are used to some extent for memorials, but such stones are classed in trade as black granite and are therefore included with the figures for monumental granite.

Basalt and related rocks (trap rock) (dimension stone) sold or used by producers in the United States in 1945, by States and uses

State	Active plants	Building stone: Rough construction: Short tons	Building stone: Rough construction: Value	Building stone: Rubble: Short tons	Building stone: Rubble: Value	Total: Short tons	Total: Value
Alaska	1			(1)	(1)	(1)	(1)
California	1			(1)	(1)	(1)	(1)
Connecticut	1	(1)	(1)			(1)	(1)
Hawaii	1	(1)	(1)	(1)	(1)	(1)	(1)
Massachusetts	1			(1)	(1)	(1)	(1)
Montana	1			(1)	(1)	(1)	(1)
New Jersey	1			(1)	(1)	(1)	(1)
Oregon	1	1,350	$9,476			1,350	$9,476
Pennsylvania	1	4,960	8,418			4,960	8,418
Undistributed		1,160	1,808	196,050	$210,693	197,210	212,501
	9	[2] 7,470	19,702	196,050	210,693	203,520	230,395
Average unit value			$2.64		$1.07		$1.13

[1] Included under "Undistributed." [2] 87,890 cubic feet (approximate).

MARBLE

Marble sales continued their gains of 1944. Value of sales was higher than in any year since 1940. The gains were greatest in building marble, sales of which were 49 percent greater in quantity and 48 percent in value than in 1944. Sales of exterior finished marble registered the most striking gain. The average value per cubic foot of building marble declined 1 percent, while that of monumental marble advanced 10 percent.

The substantial gains in sales of building marble are forerunners of much larger advances that are to be expected when activity attains momentum in public-building construction, which has been almost stagnant for several years. Both depressions and wars have a detrimental effect on the construction of permanent public buildings; accordingly, very few such buildings have been erected since 1930, and the accumulated need offers a large potential market for marble for both interior and exterior work.

Marble (dimension stone) sold by producers in the United States, 1944–45, by uses

Use	1944		1945	
	Cubic feet	Value	Cubic feet	Value
Building stone:				
Rough:				
Exterior	17,460	$27,485	24,710	$42,114
Interior [1]	40,290	75,603	59,420	132,857
Finished:				
Exterior	8,580	78,082	33,990	157,413
Interior	111,840	884,468	147,380	1,240,764
Total exterior	26,040	105,567	58,700	199,527
Total interior	152,130	960,071	206,800	1,373,621
Total building stone	178,170	1,065,638	265,500	1,573,148
Monumental stone:				
Rough	30,000	30,000		
Finished	402,370	2,771,844	438,110	3,132,284
Total monumental stone	432,370	2,801,844	438,110	3,132,284
Total building and monumental	610,540	3,867,482	703,610	4,705,432
Approximate short tons	51,900		59,690	

[1] Includes onyx for the manufacture of mantels, lamp bases, desk sets, clock cases, and novelties.

Marble (dimension stone) sold by producers in the United States in 1945, by States and uses

State	Active plants	Building		Monumental		Total		
						Quantity		
		Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value
Alabama	2	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Arkansas	1	7,700	$15,500	600	$2,000	8,300	710	$17,500
Colorado	1	(1)	(1)			(1)	(1)	(1)
Georgia	1	5,750	72,805	212,550	1,399,335	218,300	18,560	1,472,140
Maryland	1	2,570	17,640			2,570	220	17,640
Minnesota	1	(1)	(1)			(1)	(1)	(1)
Missouri	2	32,370	217,716	14,150	64,900	46,520	3,840	282,616
North Carolina	1			(1)	(1)	(1)	(1)	(1)
Tennessee	5	(1)	(1)	(1)	(1)	151,070	12,840	1,003,503
Utah [2]	1	6,910	20,475			6,910	590	20,475
Vermont	4	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed		210,200	1,229,012	210,810	1,666,049	269,940	22,930	1,891.558
	20	265,500	1,573,148	438,110	3,132,284	703,610	59,690	4,705,432
Average unit value			$5.93		$7.15			[3] $6.69
Short tons (approximate)		22,480		37,210				

[1] Included under "Undistributed."
[2] Figures represent onyx rough blocks for the manufacture of mantels, lamp bases, desk sets, clock cases, and novelties.
[3] Average value per cubic foot.

LIMESTONE

Limestone, in the form of dimension stone, is used almost exclusively for building purposes. Under normal conditions limestone is the most widely used building stone. During the war the demands for stone were so small that many firms oriented their well-equipped mills to the production of munitions, and they made a substantial contribution of materials that were necessary to winning the war. Now that the war is won, they are reconverting the mills to their accustomed functions and reopening quarries that have been idle. The reconversion problem is simple, and resumption of stone dressing will take place as rapidly as market demands will justify. Already, striking gains have been made. Production of cut stone was more than three times as great and the value per cubic foot of sales was 50 percent higher than in 1944. Sales of rough-construction stone were nearly double those of 1944, while rubble sales gained 29 percent. The total quantity of building limestone sold in 1945 was more than double that of 1944, and the sales value was more than four times as great. Even with these large gains the value of sales in 1945 was only 12 percent of the 1929 figure.

The most productive area in the United States is centered in the vicinity of Bedford and Bloomington, Ind. This area supplied 91 percent of the rough architectural and finished (sawed and cut) limestone sold in 1945.

Limestone (dimension stone) sold or used by producers in the United States in 1945, by States and uses

State	Active plants	Building — Rough — Construction — Short tons	Building — Rough — Construction — Value	Building — Rough — Architectural — Cubic feet	Building — Rough — Architectural — Value	Building — Finished (cut and sawed) — Cubic feet	Building — Finished (cut and sawed) — Value	Building — Rubble — Short tons	Building — Rubble — Value	Flagging — Cubic feet	Flagging — Value	Total — Short tons (approximate)	Total — Value
California	5	(1)	(1)	(1)	(1)	---	---	(1)	(1)	(1)	(1)	500	$1,215
Florida	3	---	---	---	---	(1)	(1)	(1)	(1)	---	---	1,230	2,765
Illinois	7	(1)	(1)	---	---	---	---	(1)	(1)	6,010	$1,643	9,700	19,816
Indiana	17	(1)	(1)	955,320	$434,173	1,140,410	$1,595,543	(1)	(1)	(1)	(1)	155,370	2,032,213
Iowa	2	(1)	(1)	---	---	---	---	---	---	(1)	(1)	(1)	(1)
Kansas	15	4,650	$6,966	---	---	---	---	2,630	$2,420	---	---	7,280	9,386
Kentucky	1	(1)	(1)	---	---	---	---	---	---	---	---	(1)	(1)
Michigan	2	(1)	(1)	---	---	---	---	---	---	(1)	(1)	(1)	(1)
Minnesota	7	2,640	6,816	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	7,620	39,621
Missouri	8	(1)	(1)	---	---	---	---	11,590	27,357	(1)	(1)	12,520	33,787
New York	1	---	---	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Ohio	3	(1)	(1)	---	---	---	---	---	---	(1)	(1)	1,070	1,715
Pennsylvania	7	9,600	17,734	---	---	---	---	(1)	(1)	(1)	(1)	11,400	19,397
Puerto Rico	9	41,350	39,059	---	---	---	---	25,920	23,045	---	---	67,270	62,104
South Dakota	1	---	---	---	---	---	---	---	---	1,880	225	150	225
Tennessee	2	(1)	(1)	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Texas	6	(1)	(1)	100,210	88,647	(1)	(1)	(1)	(1)	---	---	29,560	169,448
Vermont	1	---	---	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Virginia	2	(1)	(1)	---	---	---	---	(1)	(1)	---	---	(1)	(1)
Wisconsin	15	6,070	26,236	52,090	36,511	6,250	12,000	6,250	6,180	44,830	17,059	20,570	97,986
Wyoming	1	(1)	(1)	---	---	---	---	---	---	---	---	(1)	(1)
Undistributed	---	27,780	42,014	15,670	18,704	28,190	81,923	23,390	14,411	12,340	6,345	10,240	15,333
	115	92,090	138,825	1,123,290	578,035	1,174,850	1,689,466	69,780	73,413	65,060	25,272	334,480	2,505,011
Average unit value	---	---	$1.51	---	$0.51	---	$1.44	---	$1.05	---	$0.39	---	$7.49
Short tons (approximate)	---	(2)	---	82,010	---	85,320	---	---	---	5,280	---	---	---

1 Included under "Undistributed."

2 1,113,590 cubic feet (approximate).

The following tables show production in the Bedford–Bloomington, Ind., and the Carthage, Mo., areas over a 5-year period.

Limestone sold by producers in the Indiana oolitic limestone district, 1941–45, by classes

Year	Construction: Rough block, Cubic feet	Rough block, Value	Sawed and semifinished, Cubic feet	Sawed and semifinished, Value	Cut, Cubic feet	Cut, Value
1941	1,047,000	$309,444	1,029,970	$567,706	826,510	$1,177,651
1942	526,620	160,117	135,360	98,519	766,320	1,070,164
1943	288,750	94,500	135,580	92,034	141,200	211,019
1944	339,090	133,829	[1] 254,060	[1] 222,354	(1)	(1)
1945	955,320	434,173	739,080	571,799	401,330	1,023,744

Year	Construction—Continued: Total, Cubic feet	Total, Short tons (approximate)	Total, Value	Other uses, Short tons	Other uses, Value	Total, Short tons (approximate)	Total, Value
1941	2,903,480	210,500	$2,054,801	135,610	$98,547	346,110	$2,153,348
1942	1,428,300	103,500	1,328,800	87,770	69,404	191,270	1,398,204
1943	565,530	41,000	397,553	150,710	181,303	191,710	578,856
1944	593,150	43,000	356,183	16,380	13,690	59,380	369,873
1945	2,095,730	152,000	2,029,716	24,879	23,850	176,879	2,053,566

[1] Cut stone is included under sawed and semifinished stone.

Indiana limestone sold by mills in the district not operated by quarry companies and by mills of quarry companies from stock obtained at quarries other than their own, 1941–45, by classes

Year	Sawed and semifinished, Cubic feet	Sawed and semifinished, Value	Cut, Cubic feet	Cut, Value	Total, Cubic feet	Total, Value
1941	86,690	$47,502	690,250	$1,043,774	776,940	$1,091,276
1942	[1] 54,680	[1] 17,128	[1] 449,950	[1] 746,312	504,630	763,440
1943 [2]	(1)	(1)	[1] 232,700	[1] 362,757	232,700	362,757
1944	(1)	(1)	[1] 287,130	[1] 529,391	287,130	529,391
1945	10,840	6,454	278,820	798,372	289,660	804,826

[1] A small amount of sawed and semifinished stone included under cut stone.
[2] No stone sold from mills of quarry companies from stock obtained at quarries other than their own.

Limestone and marble sold by producers in the Carthage district, Jasper County, Mo., 1941–45, by classes

Year	Dimension stone (rough and dressed)							Other uses		Total	
	Building		Monumental		Total						
	Cubic feet	Value	Cubic feet	Value	Cubic feet	Short tons (approximate)	Value	Short tons	Value	Short tons (approximate)	Value
1941	50,000	$219,361	8,680	$19,868	58,680	4,900	$239,229	253,030	$414,770	257,930	$653,999
1942	22,580	100,581	9,590	23,271	32,170	2,650	123,852	436,600	538,697	439,250	662,549
1943	11,950	66,326	10,910	33,532	22,860	1,910	99,858	299,730	487,519	301,640	587,377
1944	14,180	94,338	14,680	58,632	28,860	2,420	152,970	218,190	476,750	220,610	629,720
1945	30,230	211,299	14,150	64,900	44,380	3,660	276,199	223,155	444,518	226,815	720,717

SANDSTONE

Sandstone as dimension stone is used principally for building purposes. Sandstone was the only major branch of the dimension-stone industry to show a decline in the quantity sold in 1945. However, this decrease was predominantly in the rough-construction stone, which sells at a relatively low price per ton. Sales of cut stone, slabs, and mill blocks gained 53 percent in quantity and 35 percent in value. Flagging sales gained moderately, but rubble and curbing output fell below that of 1944. No sales of paving stones were reported in 1945.

The total quantity of sandstone sold in 1945 was 13 percent less than in 1944; however, as the declines were chiefly in the lower-priced products and cut-stone sales made substantial gains, the overall value of sales was 12 percent greater than in 1944.

As in previous years, Ohio was the principal producer. Its quarries produced 65 percent of the total value of output in 1945. Other producing States, in order of sales value, were New York, Tennessee, Pennsylvania, and California.

The second table following presents a 23-year history of the bluestone industry. Bluestone is a type of sandstone that splits readily into thin, uniform sheets. It is particularly well-adapted for flagging but is used also for building stone and curbing. The industry has declined greatly because concrete is now used extensively for purposes for which flagstones were employed many years ago.

Sandstone (dimension stone) sold or used by producers in the United States in 1945, by States and uses

State	Active plants	Building								Rubble		Paving blocks		Curbing		Flagging		Total	
		Rough construction		Rough architectural		Dressed													
						Sawed		Cut											
		Short tons	Value	Cubic feet	Value	Cubic feet	Value	Cubic feet	Value	Short tons	Value	Number	Value	Cubic feet	Value	Cubic feet	Value	Short tons (approximate)	Value
Arizona	1	(1)	(1)															(1)	(1)
California	5	(1)	(1)	(1)	(1)					(1)	(1)					(1)	(1)	4,040	$21,590
Colorado	2	(1)	(1)	(1)	(1)	(1)	(1)									(1)	(1)	(1)	(1)
Georgia	1	100	$200							300	$600					2,500	$1,800	600	2,600
Illinois	1									(1)	(1)							(1)	(1)
Kansas	1															(1)	(1)	(1)	(1)
New York [2]	11	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			11,350	$12,812	56,700	60,695	9,790	90,825
Ohio	6	(1)	(1)	36,030	$17,674	(1)	(1)	(1)	(1)					27,640	37,166	59,220	70,059	28,790	481,986
Oklahoma	1	(1)	(1)															(1)	(1)
Pennsylvania [3]	14	1,700	5,323	(1)	(1)					(1)	(1)					42,650	22,677	9,890	47,354
Tennessee	2									4,670	40,665					8,560	21,938	5,340	62,603
Virginia	3	(1)	(1)													(1)	(1)	(1)	(1)
West Virginia	1	(1)	(1)															(1)	(1)
Wisconsin	3			(1)	(1)													(1)	(1)
Undistributed		7,420	29,753	16,610	14,144	[4] 270,590	[4] $357,776	(4)	(4)	8,180	23,786					24,500	19,882	5,790	29,992
	52	9,220	35,276	52,640	31,818	[4] 270,590	[4] 357,776	(4)	(4)	13,150	65,051			38,990	49,978	194,130	197,051	64,240	736,950
Average unit value			$3.83		$0.60		[4] $1.32		(4)		$4.95				$1.28		$1.02		$11.47
Short tons (approximate)		(5)		3,920		[4] 19,630		(4)						2,920		15,400			

[1] Included under "Undistributed."
[2] Includes 62,070 cubic feet of bluestone (approximately 5,250 tons) valued at $69,865 sold for construction, curbing, and flagging.
[3] Includes 47,260 cubic feet of bluestone (approximately 3,990 tons) valued at $19,583 sold for construction and flagging.
[4] A small quantity of cut stone is included under sawed stone.
[5] 116,580 cubic feet (approximate).

Bluestone (dimension stone) sold or used in the United States, 1923–45 [1]

Year	Cubic feet	Value	Year	Cubic feet	Value
1923	618,360	$747,422	1935	215,150	$203,537
1924	769,240	875,734	1936	343,040	332,749
1925	987,300	910,585	1937	308,740	346,349
1926	692,640	885,597	1938	329,670	369,857
1927	815,730	1,000,217	1939	254,440	319,405
1928	891,190	1,014,843	1940	256,900	272,501
1929	670,020	773,532	1941	284,190	252,313
1930	611,240	749,703	1942	183,470	166,787
1931	356,210	427,801	1943	99,840	92,059
1932	185,960	185,643	1944	156,160	108,732
1933	116,246	123,867	1945	109,330	89,448
1934	181,960	168,720			

[1] New York and Pennsylvania are the only States that produce bluestone.

MISCELLANEOUS STONE

Types of stone other than those included in the major groups already discussed are covered in the following table. The principal varieties are mica schist, argillite, light-color volcanic rocks, soapstone, and greenstone. The quantity sold in 1945 increased 22 percent and the value 23 percent compared with 1944.

Miscellaneous varieties of stone (dimension stone) sold or used by producers in the United States in 1945, by States and uses

State	Active plants	Building				Flagging		Total	
		Rough and dressed		Rubble					
		Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
California	1	(1)	(1)					(1)	(1)
Georgia	2			400	$1,600	640	$4,000	1,040	$5,600
Maryland	4	2,440	$8,567	2,050	5,294	80	616	4,570	14,477
New York	1	(1)	(1)					(1)	(1)
North Carolina	2	240	486	40	35			280	521
Pennsylvania	2	10,390	20,620					10,390	20,620
Puerto Rico	2	6,240	10,180					6,240	10,180
Virginia	2	(1)	(1)	80	452	70	1,283	(1)	(1)
Undistributed		12,440	636,432					12,590	638,167
	16	[2] 31,750	676,285	2,570	7,381	[2] 790	5,899	35,110	689,565
Average unit value			$21.30		$2.87		$7.47		$19.64

[1] Included under "Undistributed."
[2] Building stone (rough and dressed), approximately 373,530 cubic feet; flagging, approximately 9,290 cubic feet.

TRENDS IN USE OF DIMENSION STONE

A 30-year history of production of dimension stone by kinds is depicted in figure 1. Wars and depressions affect these industries adversely, as may be judged from the graph covering 1917 to 1922 and 1931 to 1945.

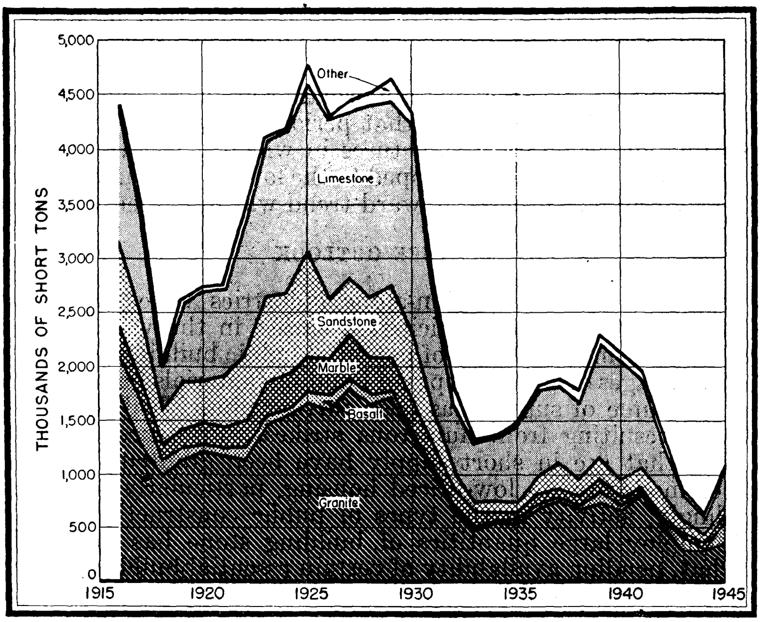

FIGURE 1.—Sales of dimension stone in the United States, by kinds, 1916–45.

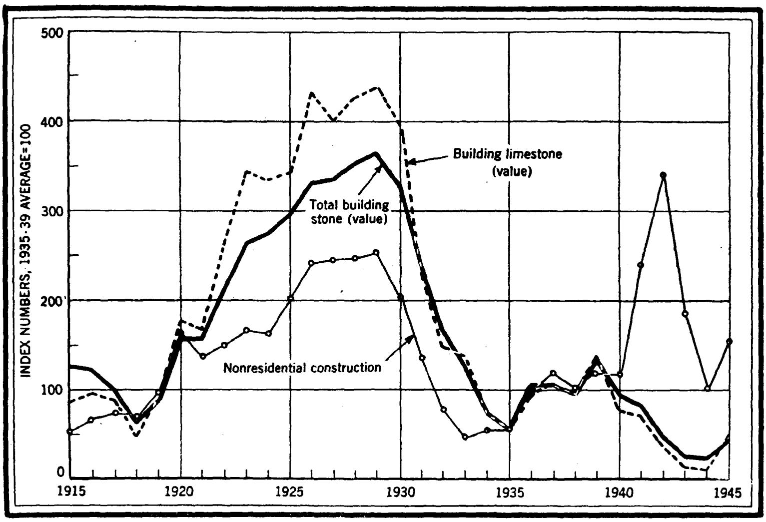

FIGURE 2.—Sales of all building stone and building limestone compared with nonresidential construction (public and private), 1915–45. Data on nonresidential building construction from Bureau of Foreign and Domestic Commerce.

Figure 2 traces for 31 years the history of production of all building stone and of the principal variety—limestone—in their relation to nonresidential building, the class of construction that normally uses stone most extensively. In general, building stone follows the trend of nonresidential construction, but since 1940 there has been no such correspondence. Because of abnormal wartime conditions nonresidential construction during that period consisted mainly of more or less temporary military structures in which very little stone was used. Building-stone sales dropped to the lowest point in their history in 1944, but an encouraging upward trend was in evidence in 1945.

FUTURE OUTLOOK

Prospects for the dimension-stone industries were not as bright late in 1945 as had been anticipated earlier in the year. Although there is an enormous backlog of potential public building construction, serious shortages of certain types of building materials have developed, and the volume of supply has been further diminished by industrial inactivity resulting from numerous strikes. Priorities for building materials that are in short supply have been granted favoring the needs of moderate- to low-priced housing, particularly for veterans. Accordingly, activity in the types of public construction that ordinarily employ large quantities of building stone has been delayed somewhat, pending availability of certain essential building materials. In nonresidential building, preference will be given to enlarging existing industrial plants or constructing new ones. Even though these various handicaps exist, a substantial increase during 1946 in educational, religious, recreational, and Government building is anticipated; thus a growing demand for dimension stone may be expected. The year 1946 will be essentially a transition period, and because of its uncertainties all forecasts must be qualified.

CRUSHED AND BROKEN STONE

About 152 million short tons of crushed and broken stone were sold in 1945, exclusive of that used for making cement and lime. Sales decreased 2 percent in quantity but gained slightly in value compared with 1944. The average value at the quarry increased 2 cents a ton.

The accompanying table of salient statistics shows the quantity sold and the value of sales during 1944 and 1945, by uses. Detailed data on asphaltic stone and slate granules and flour are given in the chapters on Asphalt and Slate.

Crushed and broken stone sold or used by producers in the United States, 1944–45, by principal uses

Use	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Concrete and road metal	64,795,490	$66,144,499	$1.02	64,108,190	$65,535,403	$1.02
Railroad ballast	18,285,060	12,556,676	.69	21,265,070	14,894,216	.70
Metallurgical	31,080,330	25,130,113	.81	27,639,520	22,076,393	.80
Alkali works	6,990,370	4,279,141	.61	7,076,330	4,068,060	.57
Riprap	4,011,210	4,947,843	1.23	4,801,170	5,589,584	1.16
Agricultural	18,941,220	25,316,219	1.34	17,395,570	25,892,317	1.49
Refractory (ganister, mica schist, dolomite, soapstone)	2,313,640	3,922,238	1.70	2,526,650	4,545,339	1.80
Asphalt filler	449,560	855,480	1.90	455,360	971,570	2.13
Calcium carbide works	509,860	476,292	.93	549,510	639,833	1.16
Sugar factories	254,410	431,462	1.70	436,170	837,470	1.92
Glass factories	512,710	820,150	1.60	460,750	792,067	1.72
Paper mills	375,490	630,425	1.68	352,990	620,943	1.76
Other uses	6,441,610	15,276,803	2.37	5,279,240	14,996,069	2.84
	154,960,960	160,787,341	1.04	152,346,520	161,459,264	1.06
Portland cement (including "cement rock") [1] Natural cement ("cement rock") [1]	24,148,000	(2)		27,332,000	(2)	
Lime [3]	12,947,000	(2)		11,841,000	(2)	
Total stone	192,056,000	(2)		191,520,000	(2)	
Asphaltic stone	740,450	2,771,925	3.74	642,600	2,565,925	3.99
Slate granules and flour	416,890	3,283,237	7.88	482,230	3,687,173	7.65

[1] Value reported as cement in chapter on Cement.
[2] No value available for stone used in manufacture of cement and lime.
[3] Value reported as lime in chapter on Lime.

The following tables show the tonnage and value of stone used for concrete aggregate, road construction, and railroad ballast for a series of years and by States for 1945.

Concrete and road metal and railroad ballast sold or used by producers in the United States, 1941–45

Year	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	110,192,610	$106,985,808	10,771,300	$7,536,451	120,963,910	$114,522,259
1942	107,701,010	105,583,801	17,566,640	10,810,977	125,267,650	116,394,778
1943	82,412,380	83,397,757	17,235,700	11,346,272	99,648,080	94,744,029
1944	64,795,490	66,144,499	18,285,060	12,556,676	83,080,550	78,701,175
1945	64,108,190	65,535,403	21,265,070	14,894,216	85,373,260	80,429,619

Concrete and road metal and railroad ballast sold or used by producers in the United States in 1945, by States

State	Concrete and road metal		Railroad ballast		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(1)	(1)	(1)	(1)	36,290	$32,045
Alaska	(1)	(1)	------	------	(1)	(1)
Arizona	110,270	$112,094	270,430	$234,510	380,700	346,604
Arkansas	377,770	325,502	[2] 22,380	[2] 20,140	[2] 400,150	[2] 345,642
California	6,598,750	4,740,897	898,350	778,983	7,497,100	5,519,880
Colorado	217,090	457,798	59,390	36,186	276,480	493,984
Connecticut	610,830	749,729	124,030	111,629	734,860	861,358
Florida	[2] 1,945,600	[2] 2,183,601	38,000	36,036	[2] 1,983,600	[2] 2,219,637
Georgia	1,063,910	1,068,793	(1)	(1)	[2] 1,063,910	[2] 1,068,793
Hawaii	1,116,250	1,913,461	(1)	(1)	[2] 1,116,250	[2] 1,913,461
Idaho	244,500	285,795	------	------	244,500	285,795
Illinois	[2] 4,662,430	[2] 4,253,124	1,080,160	837,680	[2] 5,742,590	[2] 5,090,804
Indiana	2,483,520	2,459,548	326,260	314,128	2,809,780	2,773,676
Iowa	2,021,850	2,359,771	86,320	77,594	2,108,170	2,437,365
Kansas	1,247,260	1,144,791	[2] 1,471,640	[2] 356,944	[2] 2,718,900	[2] 1,501,735
Kentucky	2,375,490	2,673,158	480,520	331,239	2,856,010	3,004,397
Louisiana	(1)	(1)	------	------	(1)	(1)
Maine	[2] 27,950	[2] 71,413	------	------	[2] 27,950	[2] 71,413
Maryland	885,050	1,117,115	192,510	225,943	1,077,560	1,343,058
Massachusetts	[2] 608,690	[2] 737,192	284,170	267,214	[2] 892,860	[2] 1,004,406
Michigan	[2] 1,563,140	[2] 1,002,129	179,290	143,228	[2] 1,742,430	[2] 1,145,357
Minnesota	[2] 819,660	[2] 903,284	(1)	(1)	878,700	959,683
Missouri	2,583,270	2,615,114	[2] 109,540	[2] 115,736	[2] 2,692,810	[2] 2,730,850
Montana	4,880	7,108	373,550	310,569	378,430	317,677
Nebraska	35,760	34,005	------	------	35,760	34,005
Nevada	67,860	92,585	------	------	67,860	92,585
New Hampshire	1,980	2,639	300	300	2,280	2,939
New Jersey	[2] 1,573,530	[2] 2,018,499	245,420	287,860	[2] 1,818,950	[2] 2,306,359
New Mexico	(1)	(1)	(1)	(1)	(1)	(1)
New York	4,205,800	4,610,790	[2] 1,084,550	[2] 946,588	[2] 5,290,350	[2] 5,557,378
North Carolina	[2] 1,884,850	[2] 2,112,108	[2] 43,690	[2] 44,851	2,213,800	2,435,287
Ohio	[2] 4,560,770	[2] 4,347,834	1,088,160	872,872	[2] 5,648,930	[2] 5,220,706
Oklahoma	[2] 1,094,510	[2] 695,075	[2] 2,421,240	[2] 302,743	3,781,470	1,205,390
Oregon	1,222,880	1,364,802	246,850	159,228	1,469,730	1,524,030
Pennsylvania	4,877,410	5,052,786	[2] 389,120	[2] 413,324	[2] 5,266,530	[2] 5,466,110
Puerto Rico	[2] 169,800	[2] 241,125	[2] 3,180	[2] 2,436	[2] 172,980	[2] 243,561
Rhode Island	[2] 2,490	[2] 4,762	------	------	[2] 2,490	[2] 4,762
South Carolina	[2] 629,440	[2] 758,306	(1)	(1)	[2] 629,440	[2] 758,306
South Dakota	130,550	169,966	1,800	2,350	132,350	172,316
Tennessee	2,804,840	3,139,306	576,740	441,754	3,381,580	3,581,060
Texas	1,128,110	1,034,208	[2] 932,800	[2] 617,104	[2] 2,060,910	[2] 1,651,312
Utah	------	------	(1)	(1)	(1)	(1)
Vermont	5,580	10,965	------	------	5,580	10,965
Virginia	2,715,710	3,101,622	[2] 580,330	[2] 502,273	[2] 3,296,040	[2] 3,603,895
Washington	[2] 1,525,500	[2] 1,446,353	1,719,190	1,571,315	[2] 3,244,690	[2] 3,017,668
West Virginia	729,520	1,012,864	514,190	444,809	1,243,710	1,457,673
Wisconsin	[2] 2,348,100	[2] 2,259,982	[2] 328,950	[2] 230,345	2,864,130	2,692,083
Wyoming	147,130	91,394	1,038,160	847,441	1,185,290	938,835
Undistributed	677,910	752,010	4,053,860	3,008,864	3,898,380	2,984,774
	64,108,190	65,535,403	21,265,070	14,894,216	85,373,260	80,429,619

[1] Included under "Undistributed."
[2] To avoid disclosing confidential information, certain totals are somewhat incomplete, the figures not included being combined under "Undistributed."

COMMERCIAL AND NONCOMMERCIAL OPERATIONS

The accompanying table shows the production of crushed stone for concrete and road metal during recent years by Government agencies of various kinds, contrasted with that by commercial enterprises. For several years prior to 1940, Government-sponsored enterprises produced 29 to 46 percent of the total output. They consisted principally of make-work organizations designed to meet unemployment and, to a lesser extent, State, county, and city highway boards or commissions. War conditions brought about a radical change in the situation. Unemployment ceased to be a problem. Highway construction, except for military roads, was virtually suspended; consequently the output of stone by State and county organizations was very small. Noncommercial production dropped to only 9 percent of the total in 1943, increased to 12 percent in 1944, and dropped to only 7 percent in 1945. This is the lowest percentage recorded for many years.

Concrete and road metal sold or used by commercial and noncommercial operators in the United States, 1941–45

[Figures for "noncommercial operations" represent tonnages reported by States, counties, municipalities, and other Government agencies, produced either by themselves or by contractors expressly for their consumption, often with publicly owned equipment; they do not include purchases from commercial producers. Figures for "commercial operations" represent tonnages reported by all other producers]

Year	Commercial operations				Noncommercial operations				Total	
	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Average value per ton	Percent of change in quantity from preceding year	Percent of total quantity	Short tons	Percent of change in quantity from preceding year
1941	75,588,820	$0.94	+36	69	34,603,790	$1.04	−7	31	110,192,610	+19
1942	92,251,930	.97	+22	86	15,449,080	1.05	−55	14	107,701,010	−2
1943	74,906,610	1.01	−19	91	7,505,770	1.05	−51	9	82,412,380	−23
1944	56,815,950	1.02	−24	88	7,979,540	1.06	+6	12	64,795,490	−21
1945	59,347,220	1.01	+4	93	4,760,970	1.12	−40	7	64,108,190	−1

GRANULES

Beginning with 1942, the coverage of granules for roofing purposes has been more complete than in former years. The following table shows total production for the past 4 years. Separate figures for slate granules are given in the chapter on Slate.

Roofing granules [1] sold or used in the United States, 1942–45, by kinds

Year	Natural		Artificially colored		Brick		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1942	352,320	$2,650,503	538,310	$7,594,174	43,230	$636,961	933,860	$10,881,638
1943	287,090	2,190,143	543,870	7,745,452	47,650	716,685	878,610	10,652,280
1944	287,080	2,210,379	637,090	9,313,356	65,830	1,005,964	990,000	12,529,699
1945	355,840	2,628,052	628,220	9,124,891	61,220	947,637	1,045,280	12,700,580

[1] Manufactured from stone, slate, slag, and brick.

SIZE OF PLANTS

The production of stone according to size of plants and number of plants in each size group has now been covered for 4 years—1941 to 1944. Figures for 1941 appear on page 1241 of the Minerals Yearbook 1942 and for 1942 on page 1300 of the volume for 1943. Figures for 1943 and 1944 are given in the following table.

The general trend during recent years has been toward an increase in the number of plants in the larger size groups and a larger percentage of total production by those groups. For instance, in 1941 there were 41 plants producing 500,000 tons or more a year, and they produced 34 percent of the total output. During the following 3 years the number of plants in that size range numbered 51 to 61, and they produced between 40 and 41 percent of the total.

Number and production of commercial crushed-stone [1] plants in 1943–44, by sizes of output

Range of output	1943				1944			
	Number of plants	Total production of plants (short tons)	Percent of total	Cumulative total (short tons)	Number of plants	Total production of plants (short tons)	Percent of total	Cumulative tota (short tons)
Less than 1,000 tons	101	44, 820	0. 03	44, 820	93	43, 330	0. 03	43, 330
1,000 to 25,000	666	6, 646, 730	4. 14	6, 691, 550	628	6, 401, 980	4. 40	6, 445, 310
25,000 to 50,000	222	7, 872, 610	4. 91	14, 564, 160	250	8, 788, 700	6. 04	15, 234, 010
50,000 to 75,000	119	7, 237, 100	4. 51	21, 801, 260	141	8, 673, 570	5. 96	23, 907, 580
75,000 to 100,000	70	6, 044, 440	3. 77	27, 845, 700	84	7, 282, 550	5. 01	31, 190, 130
100,000 to 200,000	175	23, 866, 180	14. 88	51, 711, 880	155	22, 333, 290	15. 36	53, 523, 420
200,000 to 300,000	86	21, 095, 000	13. 15	72, 806, 880	67	16, 309, 320	11. 21	69, 832, 740
300,000 to 400,000	42	14, 507, 220	9. 04	87, 314, 100	26	8, 996, 800	6. 19	78, 829, 540
400,000 to 500,000	16	7, 141, 680	4. 45	94, 455, 780	16	7, 166, 810	4. 93	85, 996, 350
500,000 to 600,000	15	8, 231, 520	5. 13	102, 687, 300	13	7, 138, 200	4. 91	93, 134, 550
600,000 to 700,000	8	5, 150, 620	3. 21	107, 837, 920	7	4, 610, 650	3. 17	97, 745, 200
700,000 to 800,000	8	6, 022, 360	3. 76	113, 860, 280	6	4, 592, 430	3. 16	102, 337, 630
800,000 to 900,000	7	5, 135, 900	3. 20	118, 996, 180	3	2, 578, 290	1. 77	104, 915, 920
900,000 tons and over	23	41, 407, 290	25. 82	160, 403, 470	22	40, 516, 940	27. 86	145, 432, 860
Total	1, 558	160, 403, 470	100. 00	160, 403, 470	1, 511	145, 432, 860	100. 00	145, 432, 860

[1] Exclusive of marble, which is primarily a dimension-stone industry.

METHODS OF TRANSPORTATION

The following table shows the quantities of commercial crushed stone for concrete and road metal conveyed during 1944 and 1945 by each of the principal methods of transportation. The percentage hauled by truck declined in 1945, while that hauled by rail increased correspondingly.

Stone for concrete and road metal sold or used by commercial producers in the United States, 1944–45, by methods of transportation [1]

Method of transportation	1944		1945	
	Short tons	Percent of total	Short tons	Percent of total
Truck	36,835,560	65	37,091,440	62
Rail	15,593,350	27	17,719,460	30
Waterway	1,813,980	3	2,355,590	4
Unspecified	2,573,060	5	2,180,730	4
	56,815,950	100	59,347,220	100

[1] For practical purposes the entire output of noncommercial operations commonly is moved by truck. Including noncommercial production, crushed stone for concrete and road metal moved as follows—1944: Truck 69 percent, rail 24 percent, water 3 percent, and unspecified 4 percent; 1945: Truck 65 percent, rail 28 percent, water 4 percent, and unspecified 3 percent.

GRANITE

Sales of crushed and broken granite increased 4 percent in quantity in 1945, but the total value of sales was almost identical with that of 1944. The average sales value per ton declined 4 cents. Sales of riprap declined considerably, and the value per ton was much lower than in 1944. Crushed granite for concrete and road metal registered a small gain, and the average value per ton was 1 cent lower than in 1944. The most decisive gain was in granite sold as railroad ballast, which advanced 48 percent in quantity and 45 percent in value. The unusually heavy rail traffic has created an urgent need of maintaining roadbeds in adequate condition. The average sales value of ballast declined 2 cents a ton.

The number of individual operations supplying noncommercial crushed stone cannot be determined with any degree of accuracy from the reports submitted. Therefore, in the accompanying tables covering granite and other kinds of crushed and broken stone, the number of active plants is not given. For many years before 1939, when noncommercial production was less important, such figures appeared in the tables.

Granite (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses

State	Riprap		Crushed stone				Other uses [1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska			(2)	(2)					(2)	(2)
Arizona	(2)	(2)							(2)	(2)
California	222,510	$260,907	796,540	$504,540	(2)	(2)	(2)	(2)	1,239,870	$905,240
Colorado	(2)	(2)					(2)	(2)	(2)	(2)
Connecticut	(2)	(2)							(2)	(2)
Georgia	(2)	(2)	948,880	897,880	(2)	(2)	80,800	$605,300	1,155,900	1,617,494
Maine	1,500	3,128	1,390	4,483			1,000	1,070	3,890	8,681
Maryland	23,910	51,224	36,000	49,300	2,200	$2,500			62,110	103,024
Massachusetts	(2)	(2)	144,980	202,456	8,000	10,800	(2)	(2)	174,890	243,195
Minnesota	(2)	(2)	26,870	38,041	(2)	(2)	5,060	15,171	159,020	138,361
Missouri			110	142					110	142
Montana	(2)	(2)	(2)	(2)					(2)	(2)
New Hampshire			1,980	2,639	300	300			2,280	2,939
New Jersey			12,630	20,228					12,630	20,228
New York	(2)	(2)							(2)	(2)
North Carolina	28,210	54,874	1,438,620	1,590,046	(2)	(2)	(2)	(2)	1,784,510	2,074,960
Oklahoma			(2)	(2)					(2)	(2)
Pennsylvania	(2)	(2)	(2)	(2)					(2)	(2)
Puerto Rico	(2)	(2)	(2)	(2)					(2)	(2)
Rhode Island	2,070	3,446	2,490	4,762			1,680	2,415	6,240	10,623
South Carolina	5,670	7,090	509,840	612,736	(2)	(2)	(2)	(2)	1,187,260	1,251,814
South Dakota							(2)	(2)	(2)	(2)
Tennessee			(2)	(2)					(2)	(2)
Vermont			(2)	(2)					(2)	(2)
Virginia	(2)	(2)	342,580	456,319	(2)	(2)	(2)	(2)	565,040	682,796
Washington	180,010	120,259					12,030	106,558	192,040	226,817
Wisconsin	(2)	(2)	58,030	36,026			(2)	(2)	64,480	46,274
Wyoming			38,140	9,500	567,600	539,200			605,740	548,700
Undistributed	121,430	91,158	141,620	172,725	1,510,840	1,383,561	102,860	210,695	162,370	190,191
	585,310	592,086	4,500,700	4,601,823	2,088,940	1,936,361	203,430	941,209	7,378,380	8,071,479
Average unit value		$1.01		$1.02		$0.93		$4.63		$1.09

1 Includes stone used for poultry grit, stone sand, and unspecified uses.

2 Included under "Undistributed."

BASALT AND RELATED ROCKS (TRAP ROCK)

Sales of crushed and broken trap rock were 5 percent greater in quantity and 1 percent greater in value in 1945 than in 1944. This classification includes the dark igneous rocks—basalt, gabbro, and diorite. The value per ton declined from $1.22 to $1.18.

Basalt and related rocks (trap rock) (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses

State	Riprap		Crushed stone				Other uses [1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	-----	-----	-----	-----	-----	-----	(2)	(2)	(2)	(2)
California	108,980	$130,653	1,129,510	$1,108,867	189,120	$143,520	71,410	$9,614	1,499,020	$1,392,654
Colorado	(2)	(2)	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Connecticut	8,130	8,165	610,830	749,729	124,030	111,629	-----	-----	742,990	869,523
Hawaii	15,610	31,230	1,116,250	1,913,461	-----	-----	455,360	423,024	1,587,220	2,367,715
Idaho	-----	-----	244,500	285,795	-----	-----	-----	-----	244,500	285,795
Maine	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Maryland	(2)	(2)	(2)	(2)	(2)	(2)	-----	-----	374,310	453,835
Massachusetts	10,700	6,596	463,710	534,736	276,170	256,414	25,370	59,311	775,950	857,057
Michigan	-----	-----	14,250	27,441	-----	-----	-----	-----	14,250	27,441
Minnesota	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Montana	(2)	(2)	-----	-----	(2)	(2)	-----	-----	176,810	150,011
New Jersey	(2)	(2)	1,438,680	1,881,925	245,420	287,860	(2)	(2)	1,896,290	2,502,759
New York	160	95	605,800	811,120	174,310	222,097	-----	-----	780,270	1,033,312
Oregon	(2)	(2)	1,170,830	1,335,002	(2)	(2)	-----	-----	1,423,430	1,501,172
Pennsylvania	(2)	(2)	650,840	748,169	(2)	(2)	-----	-----	1,055,350	1,197,664
Puerto Rico	-----	-----	550	558	3,180	2,436	-----	-----	3,730	2,994
Texas	-----	-----	(2)	(2)	(2)	(2)	-----	-----	(2)	(2)
Virginia	10,330	10,418	263,480	358,227	-----	-----	-----	-----	273,810	368,645
Washington	(2)	(2)	1,524,740	1,443,949	1,719,190	1,571,315	(2)	(2)	3,345,250	3,115,139
Wisconsin	-----	-----	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Undistributed	291,060	406,272	407,460	658,074	1,155,260	1,066,293	181,800	698,385	513,840	1,176,664
	444,970	593,429	9,641,430	11,857,053	3,886,680	3,661,564	733,940	1,190,334	14,707,020	17,302,380
Average unit value	-----	$1.33	-----	$1.23	-----	$0.94	-----	$1.62	-----	$1.18

[1] Includes stone sold for base course, fill material, roofing granules, waste, and unspecified uses. [2] Included under "Undistributed."

MARBLE

In the manufacture of marble blocks, much waste accumulates. Some of it is marketed as terrazzo or marble flour, and it also finds outlets for the same uses as those to which limestone is applied. It may be sold as agricultural limestone, as a filler, or as road stone or concrete aggregate. The great variation in unit value in different States, as indicated in the accompanying table, is due to the diversity in price among highly refined or commonplace uses.

Marble (crushed and broken stone) sold by producers in the United States in 1945, by States [1]

State	Active plants	Short tons	Value	State	Active plants	Short tons	Value
Alabama	2	(2)	(2)	Utah	1	5,640	$61,386
California	1	(2)	(2)	Virginia	1	1,230	9,818
Georgia	1	7,400	$35,400	Washington	5	(2)	(2)
Maryland	1	2,070	25,596	Undistributed		66,820	314,261
Missouri	1	960	1,810				
New York	1	(2)	(2)	Total	19	111,540	579,395
Tennessee	4	20,420	41,124	Average unit value			$5.19
Texas	1	7,000	90,000				

[1] Includes stone used for agriculture, asphalt filler, cast stone, composition flooring, crushed stone, flux, magnesia, mineral food, poultry grit, riprap, shingles, spalls, terrazzo, tile, whiting (excluding marble whiting made by companies that purchase their marble), and unspecified uses.
[2] Included under "Undistributed."

LIMESTONE

Sales of limestone were reported to the Bureau of Mines from 44 States and 2 Territories in 1945. Because of its wide distribution and relatively low cost of production, it is used more extensively than other types of stone in the United States. In 1945 limestone constituted 74 percent of all crushed and broken stone sold (excluding that used for making cement and lime), the same percentage as in 1944. Fluxing-stone sales dropped nearly 3½ million tons but were still far in advance of prewar levels. Agricultural limestone sales declined 8 percent but were still higher than in any previous year except 1944. The strong world-wide demand for agricultural products and the high buying power of farmers bear promise of a continuing heavy demand for agricultural limestone. The sales value of agricultural limestone averaged 15 cents a ton higher than in 1944. Reflecting the upward trend in building and highway construction, sales of crushed stone as concrete and road metal gained 6 percent compared with 1944. Sales of limestone as railroad ballast show little change. Sales for miscellaneous uses, which, as a whole, declined moderately, are indicated in the second table following.

Limestone (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses

State	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama			1,676,340	$1,418,182	(1)	(1)	(1)	(1)	216,980	$209,433	231,460	$1,123,986	2,161,070	$2,783,646
Arizona			(1)	(1)	(1)	(1)	(1)	(1)			(1)	(1)	362,080	317,715
Arkansas	(1)	(1)	50,000	57,500	(1)	(1)	22,380	$20,140	48,570	75,517	(1)	(1)	161,710	253,477
California	(1)	(1)	138,300	286,520	594,350	$435,166			(1)	(1)	365,650	943,916	1,100,260	1,674,726
Colorado			204,270	145,703	(1)	(1)			(1)	(1)	152,510	213,908	472,830	555,697
Connecticut			(1)	(1)					(1)	(1)	(1)	(1)	68,780	217,287
Florida	3,820	$8,363			1,945,600	2,183,601	38,000	36,036	120,320	407,149	508,210	386,551	2,615,950	3,021,700
Georgia			(1)	(1)	(1)	(1)			64,040	135,170	80,640	168,079	261,610	474,250
Hawaii							(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Idaho											2,640	8,195	2,640	8,195
Illinois	77,000	88,521	611,040	710,618	4,662,430	4,253,124	1,080,160	837,680	4,026,840	4,539,331	475,200	924,744	10,932,670	11,354,018
Indiana	17,640	16,979	21,840	19,483	2,483,520	2,459,548	326,260	314,128	1,100,680	1,260,663	81,800	190,005	4,031,740	4,260,806
Iowa	134,020	151,618	(1)	(1)	2,021,850	2,359,771	86,320	77,594	1,737,800	2,492,589	(1)	(1)	4,026,460	5,306,299
Kansas	225,910	236,387			712,250	949,942	(1)	(1)	524,790	820,868	(1)	(1)	1,634,170	2,270,696
Kentucky	(1)	(1)			2,375,490	2,673,158	480,520	331,239	592,070	669,186	(1)	(1)	3,470,770	3,740,716
Louisiana					(1)	(1)			(1)	(1)	(1)	(1)	1,000,040	756,341
Maine	2,310	1,974	80	170	800	2,100			27,480	91,915	23,500	55,114	54,170	151,273
Maryland	(1)	(1)	(1)	(1)	614,440	766,741	(1)	(1)	42,280	153,009	(1)	(1)	781,140	1,194,832
Massachusetts			(1)	(1)					195,690	614,486	(1)	(1)	236,360	750,656
Michigan	6,550	6,089	8,672,170	4,395,406	1,548,890	974,688	179,290	143,228	439,950	390,173	4,612,680	2,955,439	15,459,530	8,865,023
Minnesota	3,860	4,866	350	1,050	792,790	865,243			153,170	219,088	24,160	75,252	974,330	1,165,499
Mississippi									(1)	(1)			(1)	(1)
Missouri	523,900	637,538	14,360	18,176	2,040,210	2,455,980	109,540	115,736	985,060	1,453,607	269,970	715,281	3,943,040	5,396,318
Montana	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)			32,830	60,734	133,900	155,236
Nebraska	193,960	259,242			35,760	34,005					68,030	329,424	297,750	622,671
Nevada			(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)
New Jersey			(1)	(1)	(1)	(1)			(1)	(1)	(1)	(1)	230,610	858,849
New Mexico					(1)	(1)	(1)	(1)					361,700	173,120
New York	120,770	166,040	101,920	94,096	3,460,270	3,687,030	910,240	724,491	557,560	1,789,044	1,670,680	1,162,895	6,821,440	7,623,596
North Carolina					347,880	410,404	43,690	44,851	7,690	9,628	1,280	642	400,540	465,525
Ohio	26,320	25,205	5,002,320	3,828,968	4,560,770	4,347,834	1,088,160	872,872	1,651,980	2,058,257	747,260	1,139,585	13,076,810	12,272,721
Oklahoma	36,120	29,968	(1)	(1)	702,480	577,467	(1)	(1)	54,560	90,019	(1)	(1)	1,070,160	942,072
Oregon			(1)	(1)	(1)	(1)	(1)	(1)	38,610	289,032	29,700	89,702	73,360	386,525
Pennsylvania	57,160	66,720	8,364,940	8,367,020	3,913,330	3,925,572	360,080	380,221	1,112,680	3,114,722	1,411,800	2,384,476	15,219,990	18,238,731
Puerto Rico	(1)	(1)			163,250	226,567	(1)	(1)	(1)	(1)	(1)	(1)	174,180	239,443
South Carolina			(1)	(1)	119,600	145,570			(1)	(1)			171,510	205,815
South Dakota	4,000	6,000			79,720	97,767	1,800	2,350			2,400	3,000	87,920	109,117
Tennessee	11,130	11,465	26,120	29,960	2,766,790	3,094,866	576,740	441,754	1,217,350	1,370,655	92,810	213,420	4,690,940	5,162,120

[1] Included under "Undistributed."

Limestone (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses—Continued

State	Riprap		Fluxing stone		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Agriculture		Other		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Texas	(1)	(1)	141,160	$125,867	940,990	$932,362	932,800	$617,104	(1)	(1)	277,760	$355,122	2,389,860	$2,095,688
Utah	(1)	(1)	(1)	(1)	----------	----------	(1)	(1)	----------	----------	(1)	(1)	209,170	236,393
Vermont	----------	----------	(1)	(1)	(1)	(1)	----------	----------	(1)	(1)	(1)	(1)	95,200	669,926
Virginia	----------	----------	341,080	414,162	2,058,720	2,222,742	580,330	502,273	734,010	$831,176	808,900	898,363	4,523,040	4,868,716
Washington	----------	----------	3,020	2,592	760	2,404	----------	----------	21,630	83,424	128,940	276,387	154,350	364,807
West Virginia	----------	----------	1,913,570	1,803,975	623,270	773,885	514,190	444,809	99,290	181,751	316,320	395,280	3,466,640	3,599,700
Wisconsin	51,110	$57,806	63,030	48,303	2,279,990	2,215,847	328,950	230,345	1,248,710	1,751,034	23,310	49,829	3,995,100	4,353,164
Wyoming	(1)	(1)	(1)	(1)	(1)	(1)	470,560	308,241	----------	----------	(1)	(1)	773,910	664,220
Undistributed	282,360	258,639	293,610	308,642	609,170	654,438	1,177,190	932,590	375,780	791,391	1,223,900	2,709,535	70,510	109,173
	1,777,940	2,033,420	27,639,520	22,076,393	42,455,370	43,727,822	9,307,200	7,377,682	17,395,570	25,892,317	13,664,340	17,828,864	112,239,940	118,936,498
Average unit value	----------	$1.14	----------	$0.80	----------	$1.03	----------	$0.79	----------	$1.49	----------	$1.30	----------	$1.06

[1] Included under "Undistributed."

Limestone (crushed and broken stone) sold or used by producers in the United States for miscellaneous uses, 1944–45

Use	1944		1945	
	Short tons	Value	Short tons	Value
Alkali works	6,990,370	$4,279,141	7,076,330	$4,068,060
Calcium carbide works	509,860	476,292	549,510	639,833
Coal-mine dusting	196,470	624,217	216,160	680,723
Filler (not whiting substitute):				
Asphalt	449,560	855,480	455,360	971,570
Fertilizer	373,970	599,932	401,160	661,348
Other	236,720	677,522	138,750	428,991
Filter beds	20,880	44,064	20,920	38,322
Glass factories	512,710	820,150	460,750	792,067
Limestone sand	380,230	278,970	615,400	482,093
Limestone whiting [1]	352,490	2,554,728	343,220	2,905,637
Magnesium metal (dolomite)	652,610	983,359	(2)	(2)
Magnesia works (dolomite) [3]	220,160	450,328	295,540	373,919
Mineral food	254,150	1,193,706	291,580	1,310,757
Mineral (rock) wool	43,480	45,610	39,170	39,575
Paper mills	375,490	630,425	352,990	620,943
Poultry grit	130,450	701,194	114,670	751,469
Refractory (dolomite)	1,075,050	1,130,022	1,027,090	1,120,136
Road base	885,460	706,341	298,930	233,979
Stucco, terrazzo, and artificial stone	12,460	80,518	25,590	148,332
Sugar factories	254,410	431,462	436,170	837,470
Other uses [4]	202,140	438,703	199,800	300,319
Use unspecified	68,230	207,678	305,250	423,321
	14,197,350	18,209,842	13,664,340	17,828,864

[1] Includes stone for filler for calcimine, caulking compounds, crayons, explosives, foundry facing powder, leather goods, linoleum, paint, paper, phonograph records, plastics, pottery, putty, roofing, rubber, tanning, tooth paste, wire coating, and unspecified uses.
[2] Included under "Other uses."
[3] Includes stone for refractory magnesia.
[4] Includes stone for acid neutralization, athletic-field marking, carbon dioxide, chemicals (unspecified), concrete blocks and pipes, electric products, fill material, oil-well drilling, rayon, rice milling, spalls, spray, waste rock, water treatment, and (1945) magnesium metal.

Dolomite (calcium-magnesium carbonate) has a variety of uses, some of which are quite distinct from those of high-calcium limestone. Dead-burned dolomite is used as a refractory lining for metallurgical furnaces, and statistical data on this product (which is closely allied to lime) are given in the chapter of this volume on Lime. Raw dolomite is also used as a refractory, particularly for patching furnace floors. Dolomite is also used as a source of magnesia (MgO), which may be applied to refractory use, employed for heat insulation, or used in various other ways. In 1943, for the first time, dolomite was used extensively as a source of magnesium metal. This use has declined owing to the cut-back in the metal program.

Sales of dolomite and its primary product of calcination—dolomitic lime—for certain uses are covered in the following table.

Dolomite and dolomitic lime sold or used by producers in the United States for specified purposes, 1944–45

	1944	1945
Dolomite for—		
Basic magnesium carbonate: [1]		
Short tons	220,160	295,540
Value	$450,328	$373,919
Magnesium metal:		
Short tons	652,610	(2)
Value	$983,359	(2)
Refractory uses:		
Short tons	1,075,050	1,027,090
Value	$1,130,022	$1,120,136
Dolomitic lime for—		
Refractory (dead-burned dolomite):		
Short tons	1,290,790	1,187,330
Value	$11,441,612	$10,613,711
Paper mills:		
Short tons	46,000	52,000
Value	$347,000	$413,000
Total (calculated as raw stone) short tons	4,621,000	3,801,000

[1] Includes dolomite for refractory magnesia. [2] Bureau of Mines not at liberty to publish figures.

The use of limestone as a fluxing agent in metallurgical furnaces has attained such importance that a special table has been prepared showing the quantity and value of fluxing stone applied to various uses.

Sales of fluxing limestone, 1941–45, by uses

Year	Blast furnaces		Open-hearth plants		Other smelters [1]		Other metallurgical [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	20,244,510	$14,832,938	6,332,210	$4,469,838	481,100	$398,839	374,700	$362,544	27,432,520	$20,064,159
1942	23,663,630	18,523,158	5,843,820	4,886,157	494,720	460,270	257,080	277,728	30,259,250	24,147,313
1943	24,755,920	18,785,578	5,932,900	4,899,369	671,990	581,325	209,840	239,295	31,570,650	24,505,567
1944	24,045,890	18,954,798	6,158,870	5,251,987	557,830	547,277	317,740	376,051	31,080,330	25,130,113
1945	21,901,820	17,111,472	5,038,140	4,286,889	502,230	491,178	197,330	186,854	27,639,520	22,076,393

[1] Includes flux for copper, gold, lead, zinc, and unspecified smelters.
[2] Includes flux for foundries and for cupola and electric furnaces.

Limestone is employed not only raw but also for the manufacture of cement and lime. The latter industries are covered in separate chapters of the Minerals Yearbook. It is of interest, however, to show in one table, as follows, the total tonnage of limestone consumed for all purposes.

Limestone sold or used for all purposes in the United States, 1943–45, in short tons

Use	1943	1944	1945
Limestone (as given in this report) (approximate)	128,980,000	115,506,000	112,240,000
Portland cement (including "cement rock") [1] Natural cement ("cement rock") [1]	35,867,000	24,148,000	27,332,000
Lime [2]	13,193,000	12,947,000	11,841,000
	178,040,000	152,601,000	151,413,000

[1] Reported in terms of cement in chapter on Cement.
[2] Reported in terms of lime in chapter on Lime.

SANDSTONE

Sandstone was the only major commodity in the crushed stone industry to show a loss in sales value in 1945 compared with 1944. The quantity sold declined 32 percent and the value 23 percent. The most striking recession (55 percent) was in stone sold for concrete and road metal, and for this use the average value per ton declined from $1.14 to only 81 cents. Quartzite (ganister) sold for the manufacture of silica brick gained 22 percent in quantity and 23 percent in value. A gain was also recorded for sales of railroad ballast, but production of sandstone for riprap and "other uses" declined.

Sandstone (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses

State	Refractory stone (ganister)		Riprap		Crushed stone: Concrete and road metal		Crushed stone: Railroad ballast		Other uses [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	(2)	(2)									(2)	(2)
Arizona							(2)	(2)			(2)	(2)
Arkansas					(2)	(2)					(2)	(2)
California	(2)	(2)	(2)	(2)	1,106,890	$595,389	(2)	(2)	(2)	(2)	1,149,690	$697,269
Colorado	19,800	$32,185	(2)	(2)	(2)	(2)					38,520	52,221
Illinois	430	3,705									430	3,705
Kansas			17,900	$15,325	75,370	75,373	39,720	$37,736			132,990	128,434
Missouri			(2)	(2)							(2)	(2)
Montana			(2)	(2)			(2)	(2)			(2)	(2)
New York	(2)	(2)			(2)	(2)			(2)	(2)	(2)	(2)
North Carolina					(2)	(2)					(2)	(2)
Ohio	71,340	644,175	(2)	(2)					(2)	(2)	173,130	1,210,288
Oklahoma			(2)	(2)	(2)	(2)					(2)	(2)
Oregon					(2)	(2)					(2)	(2)
Pennsylvania	1,024,030	1,860,541	(2)	(2)	202,000	226,036	29,040	33,103	(2)	(2)	1,261,250	2,133,891
South Dakota	101,560	170,261	(2)	(2)	(2)	(2)			(2)	(2)	197,460	306,855
Tennessee					(2)	(2)					(2)	(2)
Utah	(2)	(2)									(2)	(2)
Virginia			(2)	(2)	(2)	(2)			(2)	(2)	35,310	36,160
West Virginia	(2)	(2)	(2)	(2)	(2)	(2)					195,940	379,692
Wisconsin	122,480	338,650			(2)	(2)			(2)	(2)	402,950	2,300,697
Wyoming			(2)	(2)	(2)	(2)					(2)	(2)
Undistributed	141,100	311,230	328,710	303,644	365,230	525,357	269,330	253,047	407,820	$2,549,338	735,080	725,883
	1,480,740	3,360,747	346,610	318,969	1,749,490	1,422,155	338,090	323,886	407,820	2,549,338	4,322,750	7,975,095
Average unit value		$2.27		$0.92		$0.81		$0.96		$6.25		$1.84

[1] Includes sandstone for chemical use, concrete blocks, poultry grit, rock wool, roofing granules, spalls, stone sand, waste, and unspecified uses.
[2] Included under "Undistributed."

MISCELLANEOUS STONE

Crushed and broken stone, other than the five principal varieties already discussed, includes light-color volcanic rocks, schists, boulders from river beds, serpentine, and flint. The following table shows sales of stone of these types, by States and uses, in 1945; such sales increased 13 percent in quantity and 26 percent in value over 1944.

Miscellaneous varieties of stone (crushed and broken stone) sold or used by producers in the United States in 1945, by States and uses

State	Riprap		Crushed stone				Other uses [1]		Total	
			Concrete and road metal		Railroad ballast					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alaska	(2)	(2)	(2)	(2)	-----	-----	(2)	(2)	(2)	(2)
Arizona	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Arkansas	(2)	(2)	(2)	(2)	(2)	(2)	-----	-----	769,900	$655,786
California	946,010	$927,718	2,971,460	$2,096,935	(2)	(2)	(2)	(2)	4,556,970	3,540,517
Colorado	-----	-----	9,590	9,596	59,390	$36,186	-----	-----	68,980	45,782
Florida	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Georgia	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Illinois	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Kansas [3]	-----	-----	[4] 459,640	[4] 119,476	1,431,920	319,208	-----	-----	[4] 1,891,560	[4] 438,684
Maine	22,650	34,821	25,760	64,830	-----	-----	-----	-----	48,410	99,651
Maryland	-----	-----	(2)	(2)	-----	-----	(2)	(2)	(2)	(2)
Massachusetts	(2)	(2)	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Michigan	-----	-----	(2)	(2)	-----	-----	(2)	(2)	20,010	134,803
Minnesota	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Missouri [3]	(2)	(2)	[4] 542,950	[4] 158,992	(2)	(2)	-----	-----	[4] 1,351,970	[4] 307,892
Montana	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Nevada	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
New Jersey	-----	-----	122,220	116,346	-----	-----	-----	-----	122,220	116,346
New York	-----	-----	(2)	(2)	(2)	(2)	(2)	(2)	177,750	89,392
North Carolina	-----	-----	98,350	111,658	-----	-----	-----	-----	98,350	111,658
Ohio	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Oklahoma [3]	-----	-----	392,030	117,608	2,421,240	302,743	-----	-----	2,813,270	420,351
Oregon	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Pennsylvania	(2)	(2)	(2)	(2)	-----	-----	51,540	$325,384	125,530	431,602
Puerto Rico	-----	-----	6,000	14,000	-----	-----	-----	-----	6,000	14,000
Rhode Island	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
South Carolina	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
South Dakota	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Texas	(2)	(2)	(2)	(2)	(2)	(2)	-----	-----	(2)	(2)
Virginia	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Washington	(2)	(2)	(2)	(2)	-----	-----	370	1,711	38,200	43,676
West Virginia	(2)	(2)	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Wisconsin	-----	-----	10,080	8,109	-----	-----	-----	-----	10,080	8,109
Wyoming	-----	-----	(2)	(2)	-----	-----	-----	-----	(2)	(2)
Undistributed	673,570	1,085,236	1,123,120	1,109,000	1,731,610	936,586	487,390	698,274	1,487,690	2,136,168
	1,642,230	2,047,775	5,761,200	3,926,550	5,644,160	1,594,723	539,300	1,025,369	13,586,890	8,594,417
Average unit value	-----	$1.25	-----	$0.68	-----	$0.28	-----	$1.90	-----	$0.63

[1] Includes stone used for ornamental concrete, refractory, road base, roofing granules, and spalls.
[2] Included under "Undistributed."
[3] Chats; figures collected by Joplin, Mo., office of the Bureau of Mines.
[4] A small quantity of stone included with chats.

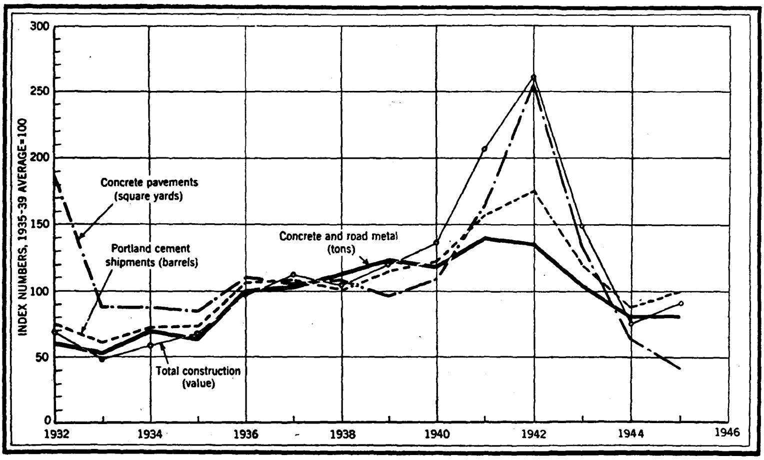

FIGURE 3.—Crushed-stone aggregates (concrete and road metal) sold or used in the United States compared with shipments of portland cement, total construction (value), and concrete pavements (contract awards, thousands of square yards), 1932–45. Data on construction and concrete pavements from Bureau of Foreign and Domestic Commerce.

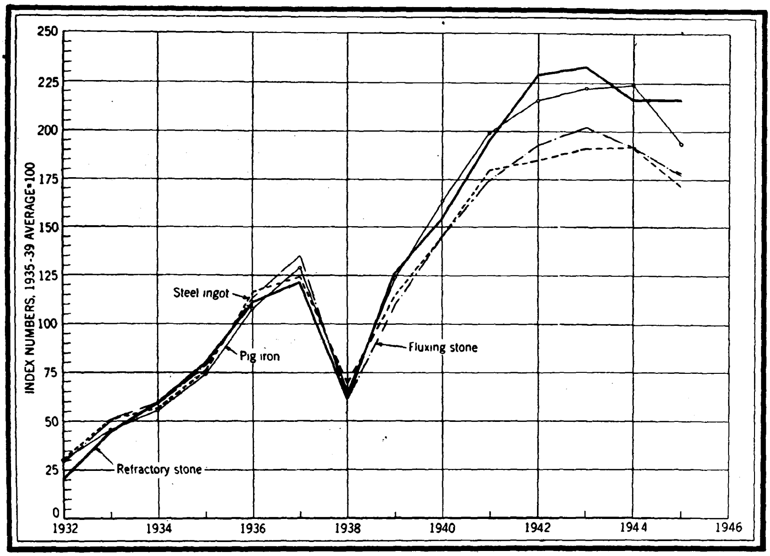

FIGURE 4.—Sales (tons) of fluxing stone and refractory stone, including that used in making lime, as recorded in the chapter on Lime, compared with production of steel ingot and pig iron, 1932–45. Statistics of steel-ingot production compiled by American Iron and Steel Institute.

MARKETS

The principal use of crushed stone is as aggregate in concrete for both highway and building construction. It is natural, therefore, that crushed-stone sales should follow the trends of portland-cement shipments, the area of new concrete pavements, and value of new construction. These relationships are indicated in figure 3. Concrete-pavement construction continued its downtrend in 1945—a drop of 36 percent compared with 1944, which, in turn, was less than half as great as in 1943. As this decline was offset to a large extent by the 20-percent increase in value of total construction, the decline in crushed-stone sales was very small. Cement shipments made substantial gains.

The metallurgical industries operated at high capacity during most of 1945. Pig-iron production of over 53 million tons was 13 percent lower than the all-time high record of 1944. Steel production of nearly 80 million tons was 10 percent below the all-high time of 1944. The market for fluxing stone was, therefore, strong until the last quarter of 1945.

A high rate of furnace production not only demands abundant supplies of fluxing stone but also large quantities of refractories to line the furnaces and keep them in repair. The principal refractories so used are dead-burned dolomite and silica brick. Ganister (quartzite) is the chief constituent of the latter. The close relationships of fluxing-stone output to pig-iron production and of refractory stone to steel-ingot manufacture over a period of years are indicated in figure 4.

OUTLOOK

The principal use of crushed stone is as aggregate for concrete in building construction and highways. The vast accumulated need for reconditioning and widening existing streets and highways, building new roads, public and private building construction, reclamation projects, and other public works furnishes an enormous potential market for aggregates. The volume of the market will depend primarily on the ability of industry and Government (Federal, State, and local) to set these innumerable projects in motion. It is to be expected, therefore, that the output of aggregates will expand steadily throughout 1946 and attain large proportions in 1947.

Production of fluxing stone and of stone for the chemical and processing industries is an important feature of the limestone industry, and demands for these products will probably be strong in consonance with the anticipated high level of industrial activity.

FOREIGN TRADE[1]

Imports of stone, which were reduced greatly during the war, showed substantial increases in 1945. Marble imports were about three times as great as in 1944 but were still quite small. Granite imports were larger than in any year since 1939. Imports of quartzite, which originate in Canada, maintained a high level. Larger imports of dimension stone are to be expected as trade is resumed with many foreign countries that were cut off during the war.

Exports of stone are never large. They show a moderate gain in 1945.

Stone imported for consumption in the United States, 1944–45, by classes

Class	1944		1945	
	Quantity	Value	Quantity	Value
Marble, breccia, and onyx:				
In blocks, rough, etc.........cubic feet..	2,487	$11,368	8,218	$44,292
Slabs or paving tiles.........superficial feet..	316	409	----------	----------
All other manufactures	----------	18,023	----------	13,854
	----------	29,800	----------	58,146
Granite:				
Dressed.........cubic feet..	582	4,507	1,137	4,509
Rough.........do....	21,979	38,115	29,219	50,239
	22,561	42,622	30,356	54,748
Quartzite.........short tons..	128,857	300,223	131,003	346,968
Travertine stone.........cubic feet..	----------	----------	7,623	19,014
Stone (other):				
Dressed	----------	175	----------	383
Rough (monumental or building stone).........cubic feet..	----------	----------	1,249	748
Rough (other).........short tons..	50,993	47,517	52,567	52,287
Marble chip or granite.........do....	----------	----------	110	1,010
	----------	47,692	----------	54,428
Grand total	----------	420,337	----------	533,304

Stone exported from the United States, 1941–45

Year	Marble and other building and monumental stone		Other manufactures of stone (value)
	Cubic feet	Value	
1941	78,640	$187,933	$415,853
1942	70,072	172,783	229,993
1943	65,614	184,772	151,650
1944	78,164	201,036	176,423
1945	119,004	337,666	174,874

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

SLATE

By Oliver Bowles and M. G. Downey

SUMMARY OUTLINE

SUMMARY

Sales of slate as a whole gained 16 percent in quantity and 13 percent in value in 1945 compared with 1944. Slate sold as dimension stone (that is, in the form of roofing slate, mill stock, etc.) gained 14 percent in quantity and 15 percent in value.

Roofing-slate sales increased 14 percent in quantity and 22 percent in value but were still abnormally low because in 1944 they reached the lowest point in the history of the industry. The average value per square in 1945 was $9.64, whereas in 1944 it was $9.00. In the Pennsylvania area sales were 8 percent higher in quantity and 15 percent higher in value than in 1944. Total roofing slate sales of New York, Vermont, and Maine, although still at a very low level, were nearly twice as great as in 1944. In the Buckingham region, Virginia, sales increased moderately.

Sales of mill stock gained only 3 percent in quantity and 4 percent in value, and sales of electrical slate, blackboards and bulletin boards, and school slates all registered gains. On the other hand, sales of structural and sanitary slate, vaults and covers, and billiard-table tops suffered substantial losses. The continued decline in sales of structural and sanitary slate reflects the low level of public building construction. Sales of flagstones, stepping stones, and similar products gained 34 percent in quantity and 25 percent in value.

Statistics on slate granules and flour are included in this chapter although they have little in common with the slate products already mentioned. Granules are, in fact, used in making roofing products that compete in the roofing-slate market, but most of the slate used in the manufacture of granules and flour is unsuited for other slate products. The gains of 16 percent in quantity and 12 percent in value for 1945 compared with 1944 probably reflect an increasing volume of reroofing rather than the demands of new construction. In 1945 the average sales value of granules f. o. b. mill was $8.80 and of flour $3.61 per short ton compared with $9.25 and $3.92, respectively, in 1944. These products therefore reversed the almost universal uptrend in unit values in 1945. Figures for sales of granules of all kinds, including slate, are given in the chapter of this volume on Stone.

The following table presents the principal statistical data for the slate industry in 1944 and 1945.

Salient statistics of the slate industry in the United States, 1944–45

	1944			1945				
	Quantity			Quantity			Percent of changes in—	
	Unit of measurement	Approximate equivalent short tons	Value	Unit of measurement	Approximate equivalent short tons	Value	Quantity (unit as reported)	Value
Domestic production (sales by producers):								
Roofing slate	*Squares* 89,090	32,750	$802,179	*Squares* 101,300	38,240	$976,122	+13.7	+21.7
Mill stock:	*Sq. ft.*			*Sq. ft.*				
Electrical slate	349,480	2,930	264,088	363,210	3,100	283,650	+3.9	+7.4
Structural and sanitary slate	391,280	3,250	151,069	314,200	2,480	135,671	−19.7	−10.2
Grave vaults and covers	351,230	3,360	105,501	314,710	2,850	88,146	−10.4	−16.5
Blackboards and bulletin boards	502,750	1,270	121,048	649,510	1,650	170,392	+29.2	+40.8
Billiard-table tops	190,190	1,400	67,168	158,580	1,160	56,453	−16.6	−16.0
School slates	[1] 256,280	230	6,815	[1] 307,570	280	8,033	+20.0	+17.9
Total mill stock	2,041,210	12,440	715,689	2,107,780	11,520	742,345	+3.3	+3.7
Flagstones, etc.[2]	2,235,960	15,760	203,090	2,995,670	19,900	253,273	+34.0	+24.7
Total slate as dimension stone		60,950	1,720,958		69,660	1,971,740	+14.3	+14.6
Granules and flour		416,890	3,283,237		482,230	3,687,173	+15.7	+12.3
Grand total domestic production		477,840	5,004,195		551,890	5,658,913	+15.5	+13.1

[1] Square feet approximate. Number of pieces: 1944, 479,030; 1945, 353,400.
[2] Includes slate used for walkways, stepping stones, and miscellaneous uses.

SALES

Dimension slate.—The term "dimension slate" is applied to blocks or slabs of specified sizes and shapes. It includes all slate products except granules and flour. The following table shows sales of dimension slate for a 5-year period.

Slate (other than granules and flour) sold by producers in the United States, 1941–45

Year	Roofing			Mill stock		Other[1]		Total	
	Squares	Approximate equivalent short tons	Value	Approximate short tons	Value	Approximate short tons	Value	Approximate short tons	Value
1941	378,980	140,830	$3,180,766	18,680	$1,076,814	21,480	$152,254	180,990	$4,409,834
1942	192,070	71,400	1,704,053	18,720	1,112,426	16,910	139,328	107,030	2,955,807
1943	96,220	35,370	841,750	15,950	938,368	21,990	166,231	73,310	1,946,349
1944	89,090	32,750	802,179	12,440	715,689	15,760	203,090	60,950	1,720,958
1945	101,300	38,240	976,122	11,520	742,345	19,900	253,273	69,660	1,971,740

[1] Includes flagstones, walkways, stepping stones, and miscellaneous slate.

As roofing slate is used chiefly in residential building it is interesting to follow the trend of roofing-slate sales compared with the number of new dwelling units built. This relationship is indicated in figure 1. From 1929 to 1938 slate sales compared favorably with the normally expected requirements of the very small building programs of those years, but since 1938 they have fallen far below the normal demands of new dwelling units erected. This condition is probably due to the prevalence during war years of housing construction so low-priced or so temporary in character that slate was not a suitable material.

Mill-stock slate is used most widely in nonresidential building, and sales of mill stock have followed rather closely the trend of such construction since 1925. During the war years both nonresidential building and mill-stock sales were at a low level. The relationships are shown in figure 1.

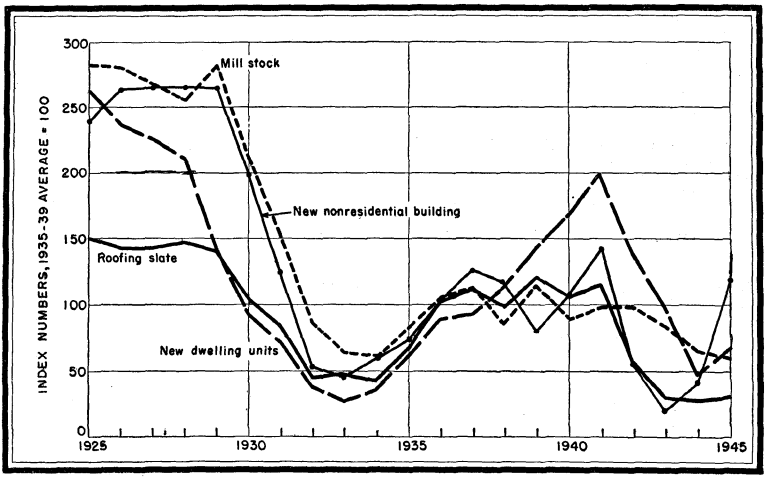

FIGURE 1.—Sales of roofing slate and mill stock compared with number of new dwelling units and value of new nonresidential building, 1925–45. Data on new nonresidential building from Bureau of Foreign and Domestic Commerce, on new dwelling units from Bureau of Labor Statistics.

Figure 2 presents graphically a statistical history of slate over a 31-year period, by uses. The chart illustrates the relative inactivity in the slate industry, brought about by both wars and depressions.

Figure 3 presents the history of slate production, by uses, on a quantity basis. The large-tonnage products that have a relatively low unit value assume greater prominence in this chart than in figure 2.

Granules and flour.—Granules are used chiefly in surfacing prepared roofing. Flour, most of which is recovered as a byproduct of the granule industry, is used as a filler in road-asphalt surface mixtures, paints, roofing mastic, linoleum, and various other products. The substantial gain in sales of granules in 1945 is remarkable in view of the low level of building construction. Maintenance and repair evidently consumed a large part of it. Sales for a 5-year period are indicated in the accompanying table.

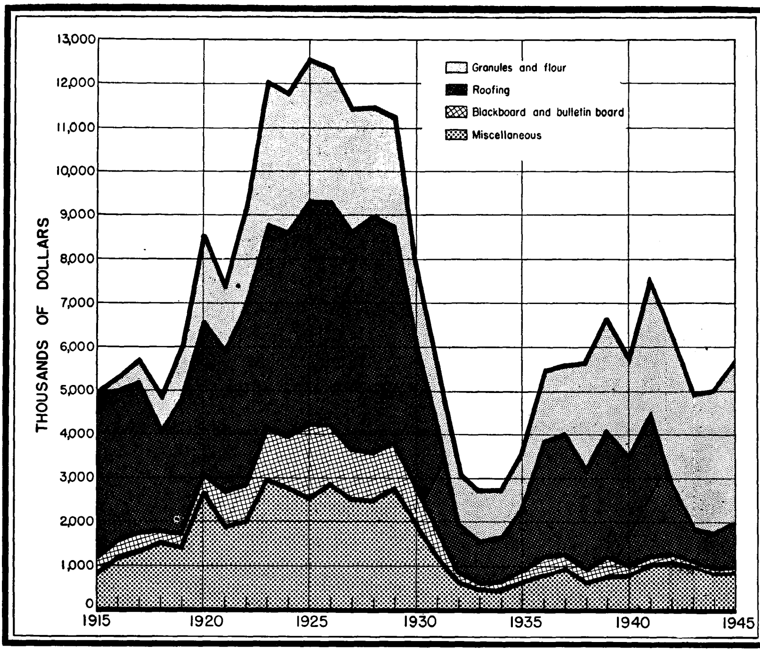

Figure 2.—Value of slate sold in the United States, 1915–45, by uses.

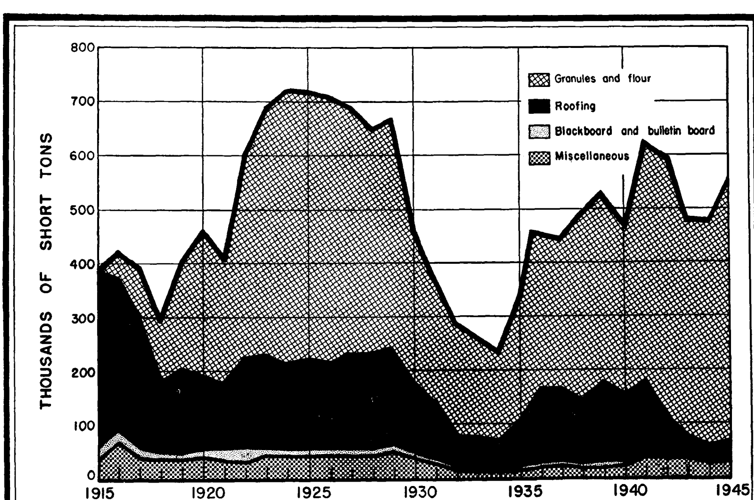

Figure 3.—Quantity of slate sold in the United States, 1915–45, by uses.

Crushed slate (granules and flour) sold by producers in the United States, 1941–45

Year	Granules		Flour		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	323,740	$2,708,246	113,930	$397,554	437,670	$3,105,800
1942	356,510	2,955,562	127,230	448,854	483,740	3,404,416
1943	292,330	2,547,399	103,220	376,489	395,550	2,923,888
1944	309,170	2,861,014	107,720	422,223	416,890	3,283,237
1945	374,800	3,299,593	107,430	387,580	482,230	3,687,173

PRICES

The average price of roofing slate, f. o. b. quarry or mill, as reported to the Bureau of Mines increased 64 cents a square in 1945 compared with 1944. In Pennsylvania it increased 52 cents a square, in Virginia 51 cents, and in the New York-Vermont and Maine areas $1.06.

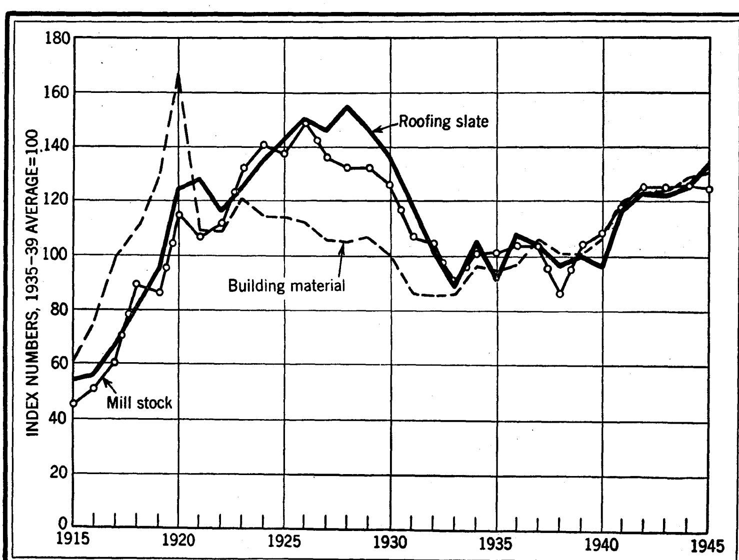

FIGURE 4.—Prices of slate compared with wholesale prices of building materials in general, 1915–45. Wholesale prices from Bureau of Labor Statistics.

The average value of mill stock remained unchanged at 35 cents per square foot. The average value of electrical slate increased 2 cents, structural and sanitary slate 4 cents, blackboards and bulletin boards 2 cents, and billiard-table tops 1 cent per square foot compared with 1944. The average value per square foot of vaults and covers declined 2 cents. The sales value of granules declined 45 cents and of slate flour 31 cents a short ton.

Price history.—Figure 4 shows the trend of slate prices compared with prices of all building materials over a 31-year period. During recent years they have been in remarkably close accord.

REVIEW BY STATES AND DISTRICTS

The following table gives sales of slate in 1945, by States and uses.

Slate sold by producers in the United States in 1945, by States and uses

State	Operators	Roofing		Mill stock		Other uses (value) [1]	Total value
		Squares (100 square feet)	Value	Square feet	Value		
Arkansas	1					$50,000	$50,000
California	1					(2)	(2)
Georgia	1					(2)	(2)
Maryland	1					(2)	(2)
New York	6	(3)	(3)			857,465	[3] 857,465
Pennsylvania [4]	17	75,970	$704,061	1,767,530	$462,432	763,248	1,929,741
Vermont and Maine	14	[3] 16,020	[3] 170,594	340,250	279,913	1,466,469	[3] 1,916,976
Virginia	5	9,310	101,467			(2)	(2)
Undistributed						803,264	904,731
Total: 1945	46	101,300	976,122	2,107,780	742,345	3,940,446	5,658,913
1944	44	89,090	802,179	2,041,210	715,689	3,486,327	5,004,195

[1] Flagging and similar products, granules, and flour.
[2] Included under "Undistributed."
[3] Roofing slate in New York included with Vermont and Maine.
[4] For details of production in Pennsylvania, see following table.

Maine.—The principal product of the quarries near Monson is electrical slate. As in 1944, only one company was active.

New York-Vermont.—In order that the output of an individual firm may not be revealed, Maine has been included with Vermont in the accompanying table. The total value of slate products sold in Vermont and Maine was approximately 21 percent greater in 1945 than in 1944, although the figures are not quite comparable because roofing-slate production in New York is included with Vermont and Maine in 1945 but not in 1944. Roofing-slate production in Vermont increased substantially in 1945, and sales of the colored slates of this area may be expected to increase greatly when moderate- to high-priced residential building construction revives. Production in New York, which consisted chiefly of granules, was considerably higher than in 1944.

Peach Bottom district.—The slate quarries in the area near Cardiff, Md., and Delta, Pa., produced only granules and flour in 1945, although they are potential producers of high-quality roofing slate.

Lehigh district.—The quarries of Lehigh and Northampton Counties, Pa., furnish all types of slate products and comprise the most productive slate area in the United States. As separate figures may not be shown for York County, which includes part of the Peach Bottom district, it is included with Northampton County in the accompanying table showing detailed figures for Pennsylvania.

The total value of all slate products sold in the Lehigh district in 1945 was 6 percent higher than in 1944. Roofing-slate sales were 8 percent higher in quantity and 15 percent higher in value. Mill-stock products are more important than roofing in this district. The total value of mill products sold was less than 1 percent greater than in 1944. Sales of blackboards and bulletin boards gained 29 percent in quantity and 41 percent in value, and school slates 20 percent in quantity and 18 percent in value. On the other hand, sales of the following mill-stock products declined decidedly: Electrical (23 percent in quantity and 22 percent in value), structural and sanitary (21 percent in quantity and 12 percent in value), vaults and covers (10 percent in quantity and 16 percent in value), and billiard-table tops (16 percent in quantity and 15 percent in value). The value of miscellaneous products (chiefly granules and flour) gained 1 percent. Most of the slate in this area is a blue-black "soft-vein" well-adapted for structural products as well as for roofing. Detailed figures for production in Pennsylvania are given in the following table.

Slate sold by producers in Pennsylvania in 1945, by counties and uses

County	Operators	Roofing slate		Mill stock					
				Electrical		Structural and sanitary		Vaults and covers	
		Squares (100 square feet)	Value	Square feet	Value	Square feet	Value	Square feet	Value
Lehigh	5	4,720	$44,320	31,320	$12,882	1,650	$634	180	$54
Northampton and York [1]	12	71,250	659,741	20,920	8,168	297,140	125,539	307,920	84,904
Total:									
1945	17	75,970	704,061	52,240	21,050	298,790	126,173	308,100	84,958
1944	18	70,220	614,077	67,530	26,985	380,180	142,981	341,420	101,679

County	Mill stock—Continued						Other uses (value)	Total value
	Blackboards and bulletin boards		Billiard-table tops		School slates			
	Square feet	Value	Square feet	Value	Square feet	Value		
Lehigh	106,850	$22,852			307,570	$8,033	$7	$88,782
Northampton and York [1]	542,620	147,507	151,360	$51,859			763,241	1,840,959
Total:								
1945	649,470	170,359	151,360	51,859	307,570	8,033	763,248	1,929,741
1944	502,730	121,030	179,800	61,069	256,280	6,815	753,260	1,827,896

[1] York County produced granules and flour only.

Virginia.—The principal product of the Buckingham County quarries is roofing slate. Output gained 4 percent in quantity and 9 percent in value in 1945 compared with 1944. Because of the small number of operators, sales of granules and flour may not be shown.

Other districts.—Slate products, chiefly granules and flour, were produced in Montgomery County, Ark., near Glenwood; near Placerville, El Dorado County, Calif.; and in Bartow County, Ga., near Fair Mount.

NEW DEVELOPMENTS

Pennsylvania State College is conducting a research program in which emphasis is placed on the development of new products from waste slate. The manufacture of expanded aggregates for use in lightweight concrete is among the most promising. Preliminary tests indicate favorable strength-to-weight ratios. In 1945 a 31-ton sample of waste slate was shipped to Ironton, Ohio, where the Alpha Portland Cement Co. passed it through one of its cement kilns. A satisfactory aggregate that would float on water was obtained at a calcination temperature of about 2,100° F. Progress has also been made toward evaluating the microscopic, X-ray, and chemical characteristics of slate.

OUTLOOK FOR THE FUTURE

The degree of prosperity in the slate industry depends primarily on the volume of residential construction. The shortage of housing that resulted first from the prolonged depression of the 1930's, and intensified by the war conditions that followed, had reached such proportions that it became a leading national problem early in 1946. A need exists for millions of homes, and a building program of large proportions will undoubtedly get under way when manpower shortages in the building-material-supply industries are relieved and some solution is found for the difficult labor-relations problems. Slate should benefit greatly from an enlarged program of residential building. There is, however, a possibility that the urgency of the need for human shelter will stimulate a type of construction so low in unit cost that slate will be used sparingly. Such a contingency looms large only so long as building materials are in such short supply that a large proportion will be allocated to low-priced housing. When the raw materials of construction become plentiful, homes of the better class will doubtless be built in large numbers because the need for them exists and the funds to finance them are available. A great revival in slate sales is definitely in view; when it will materialize is problematical; but the strong uptrend in residential building early in 1946 is encouraging. The greatest handicap to increased slate production early in 1946 was manpower shortage.

FOREIGN TRADE [1]

Imports.—As indicated in the following table, slate imports have been very small during recent years.

Slate imported for consumption in the United States 1939–45, by countries [1]

Country	1939	1940	1941	1942	1944
Canada	$570		$189	$177	
China	26	$21	45		
Hong Kong	4		26		
Italy	356	324			
Japan	61	175	7		
Mexico					$50
United Kingdom			1,381		1
	1,017	520	1,648	177	51

[1] No imports during 1943 and 1945.

[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Exports.—The following table lists the value of exports of slate products for a 5-year period as reported to the Bureau of Mines by shippers. The gain of 36 percent in value of exports in 1945 over 1944 is encouraging.

Slate exported from the United States, 1941–45, by uses [1]

<table>
<tr><th>Use</th><th>1941</th><th>1942</th><th>1943</th><th>1944</th><th>1945</th></tr>
<tr><td>Roofing</td><td>$4,211</td><td>(2)</td><td>(2)</td><td>$5,398</td><td>$3,465</td></tr>
<tr><td>School slates [3]</td><td>46,490</td><td>$26,481</td><td>$18,939</td><td>24,008</td><td>4,751</td></tr>
<tr><td>Electrical</td><td>4,644</td><td>6,163</td><td>3,461</td><td>3,782</td><td>2,490</td></tr>
<tr><td>Blackboards</td><td>5,206</td><td>6,112</td><td>5,861</td><td>14,674</td><td>20,211</td></tr>
<tr><td>Billiard tables</td><td>46,612</td><td>54,669</td><td>87,834</td><td>75,797</td><td>161,439</td></tr>
<tr><td>Structural [4]</td><td rowspan="2">158,100</td><td>(2)</td><td>(2)</td><td rowspan="2">180,697</td><td>2,316</td></tr>
<tr><td>Slate granules and flour</td><td>(2)</td><td>(2)</td><td>219,933</td></tr>
<tr><td>Undistributed</td><td></td><td>146,794</td><td>150,346</td><td></td><td></td></tr>
<tr><td></td><td>265,263</td><td>240,219</td><td>266,441</td><td>304,356</td><td>414,605</td></tr>
</table>

[1] Figures collected by the Bureau of Mines from shippers of products named.
[2] Included under "Undistributed."
[3] Includes slate used for pencils and educational toys.
[4] Includes slate for floors and walkways.

SAND AND GRAVEL

By G. W. Josephson and G. E. Tucker

SUMMARY OUTLINE

SUMMARY

In the first half of 1945 the sand and gravel industry marked time, but after the end of hostilities sales for building construction increased rapidly. On the other hand, sales of industrial sands decreased in the latter part of the year as industry was reconverted to peacetime production. Highway construction was slow in starting, so little postwar activity was noticeable in paving material figures in 1945. Over-all production was slightly higher in 1945 than in 1944. Prices increased, as did wages and many other costs.

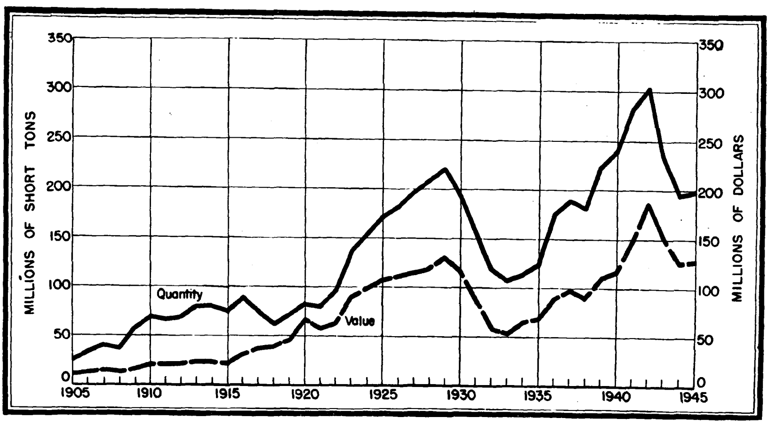

Figure 1.—Total production of sand and gravel in the United States, 1905–45.

FUTURE OUTLOOK

The predicted boom in building construction was well on the way to realization by the end of 1945. Home-construction needs of the country are of a magnitude that can keep the building industry busy for years, and this demand is supplemented by substantial needs for commercial buildings. At present there appears to be enough savings and credit available to finance the program if neither runaway inflation nor deflation destroys the purchasing power of the people who intend to own the homes.

Some funds for highway construction are now available; and, although Government agencies are reluctant to appropriate money for huge programs, road-building activity is expected to increase.

As the prospects of the manufacturing industries are generally conceded to be favorable, demand for industrial sand should likewise be active in the immediate future.

Sand and gravel sold or used by producers in the United States, 1944–45, by commercial and Government-and-contractor operations and by uses

	1944			1945			Percent of change in—	
	Short tons	Value		Short tons	Value			
		Total	Average		Total	Average	Tonnage	Average value
COMMERCIAL OPERATIONS								
Sand:								
Glass	4,443,031	$8,227,502	$1.85	4,681,920	$8,374,218	$1.79	+5.4	−3.2
Molding	8,983,075	11,752,360	1.31	7,190,856	9,724,750	1.35	−20.0	+3.1
Building	26,356,834	16,154,889	.61	30,490,146	18,812,208	.62	+15.7	+1.6
Paving	16,886,764	10,319,762	.61	16,681,521	10,428,371	.63	−1.2	+3.3
Grinding and polishing [1]	897,983	1,563,511	1.74	642,511	1,029,501	1.60	−28.4	−8.0
Fire or furnace	362,978	479,711	1.32	308,997	387,872	1.26	−14.9	−4.5
Engine	2,852,648	1,993,119	.70	2,771,896	1,924,725	.69	−2.8	−1.4
Filter	146,008	263,922	1.81	109,845	231,026	2.10	−24.8	+16.0
Railroad ballast [2]	1,211,894	381,489	.31	1,082,626	400,762	.37	−10.7	+19.4
Other [3]	1,388,749	1,012,608	.73	1,116,353	1,117,153	1.00	−19.6	+37.0
Total commercial sand	63,529,964	52,148,873	.82	65,076,671	52,430,586	.81	+2.4	−1.2
Gravel:								
Building	25,946,102	19,729,145	.76	27,910,042	21,735,554	.78	+7.6	+2.6
Paving	37,043,972	26,199,925	.71	36,759,164	25,693,994	.70	−.8	−1.4
Railroad ballast [4]	21,267,398	9,433,662	.44	20,657,982	9,518,328	.46	−2.9	+4.5
Other [5]	2,845,645	1,284,632	.45	1,734,439	1,043,910	.60	−39.0	+33.3
Total commercial gravel	87,103,117	56,647,364	.65	87,061,627	57,991,786	.67	------	+3.1
Total commercial sand and gravel	150,633,081	108,796,237	.72	152,138,298	110,422,372	.73	+1.0	+1.4
GOVERNMENT-AND-CONTRACTOR OPERATIONS [6]								
Sand:								
Building	856,000	474,000	.55	1,018,000	428,000	.42	+18.9	−23.6
Paving	4,592,000	1,431,000	.31	5,631,000	1,998,000	.35	+22.6	+12.9
Total Government-and-contractor sand	5,448,000	1,905,000	.35	6,649,000	2,426,000	.36	+22.0	+2.9
Gravel:								
Building	2,663,000	1,626,000	.61	2,145,000	1,225,000	.57	−19.5	−6.6
Paving	36,039,000	12,837,000	.36	34,592,000	14,764,000	.43	−4.0	+19.4
Total Government-and-contractor gravel	38,702,000	14,463,000	.37	36,737,000	15,989,000	.44	−5.1	+18.9
Total Government-and-contractor sand and gravel	44,150,000	16,368,000	.37	43,386,000	18,415,000	.42	−1.7	+13.5
COMMERCIAL AND GOVERNMENT-AND-CONTRACTOR OPERATIONS								
Sand	68,978,000	54,054,000	.78	71,726,000	54,856,000	.76	+4.0	−2.6
Gravel	125,805,000	71,110,000	.57	123,798,000	73,981,000	.60	−1.6	+5.3
Grand total	194,783,000	125,164,000	.64	195,524,000	128,837,000	.66	+.4	+3.1

[1] Includes blast sand as follows—1944: 482,293 tons valued at $1,228,744; 1945: 318,390 tons, $766,013.
[2] Includes ballast sand produced by railroads for their own use as follows—1944: 40,486 tons valued at $10,263; 1945: 17,792 tons, $2,429.
[3] Includes some sand used by railroads for fills and similar purposes as follows—1944: 286,965 tons valued at $57,060; 1945: 220,244 tons, $44,356.
[4] Includes ballast gravel produced by railroads for their own use as follows—1944: 9,097,590 tons valued at $2,896,111; 1945: 8,587,465 tons, $2,987,940.
[5] Includes some gravel used by railroads for fills and similar purposes as follows—1944: 1,605,789 tons valued at $308,780; 1945: 843,969 tons, $133,494.
[6] Approximate figures for States, counties, municipalities, and other Government agencies directly or under lease.

PRODUCTION

After reaching a record total of over 304,000,000 tons in 1942, production of sand and gravel declined in the following 2 years, but in 1945 the trend was reversed—output was 0.4 percent greater than in 1944. The increase was principally in the production of building sand and gravel. With the exception of glass sand, the tonnage of the industrial sands declined substantially, and postwar highway construction programs had not yet shown their full effect on paving materials. As stocks of sand and gravel are relatively small and constant from year to year, production virtually equals sales. The terms are used interchangeably in this report.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States, 1941–45

Year	Sand		Gravel (including railroad ballast)		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	103, 835, 000	$62, 152, 000	184, 880, 000	$85, 055, 000	288, 715, 000	$147, 207, 000
1942	107, 371, 000	74, 443, 000	196, 975, 000	114, 057, 000	304, 346, 000	188, 500, 000
1943	82, 053, 000	62, 263, 000	152, 011, 000	90, 530, 000	234, 064, 000	152, 793, 000
1944	68, 978, 000	54, 054, 000	125, 805, 000	71, 110, 000	194, 783, 000	125, 164, 000
1945	71, 726, 000	54, 856, 000	123, 798, 000	73, 981, 000	195, 524, 000	128, 837, 000

California produced more than any other State, and Illinois, Michigan, and Texas followed in that order. In only these four States did output total more than 10,000,000 tons. The following tables show details of production, by States and uses, in 1945.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States

State	Short tons	Value	State	Short tons	Value
Alabama	2, 541, 769	$1, 580, 687	Nevada	999, 781	$914, 476
Alaska	(1 2)	(1 2)	New Hampshire	[1] 943, 076	[1] 93, 812
Arizona	528, 059	442, 959	New Jersey	4, 506, 379	4, 652, 938
Arkansas	2, 688, 622	1, 930, 780	New Mexico	[2] 448, 438	[2] 317, 968
California	21, 599, 950	15, 176, 259	New York	7, 477, 628	5, 049, 905
Colorado	1, 800, 405	1, 147, 027	North Carolina	2, 394, 089	1, 517, 203
Connecticut	1, 611, 216	841, 509	North Dakota	1, 769, 086	523, 163
Delaware	82, 674	43, 678	Ohio	9, 420, 380	7, 985, 018
Florida	1, 314, 011	1, 074, 055	Oklahoma	1, 274, 186	761, 448
Georgia	605, 036	350, 264	Oregon	4, 476, 504	3, 681, 255
Hawaii	(2)	(2)	Pennsylvania	6, 768, 944	7, 247, 613
Idaho	1, 597, 112	952, 971	Puerto Rico	(2)	(2)
Illinois	12, 613, 555	8, 606, 155	Rhode Island	317, 300	221, 530
Indiana	6, 947, 958	4, 115, 842	South Carolina	319, 933	202, 335
Iowa	6, 030, 531	2, 091, 391	South Dakota	2, 642, 494	1, 106, 983
Kansas	3, 082, 392	1, 674, 742	Tennessee	3, 097, 626	2, 578, 379
Kentucky	1, 174, 510	1, 033, 424	Texas	11, 038, 244	7, 595, 904
Louisiana	2, 797, 571	2, 585, 945	Utah	2, 147, 910	1, 280, 578
Maine	1, 888, 778	771, 724	Vermont	134, 977	61, 172
Maryland	2, 898, 808	2, 694, 876	Virginia	2, 965, 270	2, 721, 351
Massachusetts	2, 928, 420	1, 696, 387	Washington	6, 949, 809	3, 872, 633
Michigan	12, 199, 977	6, 107, 890	West Virginia	2, 501, 773	3, 323, 289
Minnesota	9, 125, 117	2, 402, 530	Wisconsin	8, 384, 279	4, 111, 282
Mississippi	1, 606, 345	812, 046	Wyoming	1, 541, 369	693, 239
Missouri	3, 489, 775	2, 780, 467	Undistributed [3]	5, 934, 000	4, 387, 000
Montana	[2] 2, 035, 192	[2] 1, 067, 295			
Nebraska	3, 882, 461	1, 956, 560		195, 524, 000	128, 837, 000

[1] Output of commercial producers included under "Undistributed."
[2] Output of Government-and-contractor operations included under "Undistributed."
[3] Items covered by "1" and "2".

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States and uses

[Commercial unless otherwise indicated]

State	Sand							
	Glass		Molding		Building			
					Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	-	-	89,741	$100,992	448,327	$278,994	-	-
Alaska	-	-	-	-	(1)	(1)	(1)	(1)
Arizona	-	-	-	-	129,959	126,938		
Arkansas	(1)	(1)	(1)	(1)	281,806	187,917	-	-
California	264,697	$540,719	137,173	288,843	5,273,621	3,121,894	29,126	$22,569
Colorado	-	-	(1)	(1)	289,013	155,654	64,105	82,774
Connecticut	5,000	22,500	(1)	(1)	395,369	247,824	408,640	29,189
Delaware	-	-	3,200	1,780	350	175	-	-
Florida	-	-	-	-	675,325	537,826	-	-
Georgia	7,132	11,473	16,868	6,030	190,892	91,914	945	1,400
Hawaii	-	-	-	-	-	-	(1)	(1)
Idaho	-	-	-	-	75,984	63,083	44,007	46,072
Illinois	(1)	(1)	1,314,090	1,605,567	1,916,119	918,911	-	-
Indiana	-	-	412,303	283,939	839,664	447,780	-	-
Iowa	-	-	11,588	9,840	704,852	391,493	150	600
Kansas	-	-	-	-	564,113	299,559	13,825	2,902
Kentucky	-	-	4,542	10,193	275,023	238,212	-	-
Louisiana	-	-	(1)	(1)	484,511	302,574	-	-
Maine	-	-	-	-	44,727	24,121	-	-
Maryland	(1)	(1)	-	-	796,911	668,509	-	-
Massachusetts	-	-	(1)	(1)	746,594	401,822	135	100
Michigan	(1)	(1)	(1)	(1)	1,258,904	547,900	2,421	252
Minnesota	(1)	(1)	11,770	13,242	1,007,036	403,261	30,063	18,571
Mississippi	-	-	9,883	8,785	156,655	75,406	-	-
Missouri	(1)	(1)	(1)	(1)	503,480	322,760	-	-
Montana	-	-	-	-	99,906	80,435	(1)	(1)
Nebraska	-	-	(1)	(1)	450,608	221,654	-	-
Nevada	(1)	(1)	(1)	(1)	(1)	(1)	36,300	32,173
New Hampshire	-	-	-	-	(1)	(1)	-	-
New Jersey	(1)	(1)	1,559,855	2,561,259	907,806	511,055	135	150
New Mexico	-	-	-	-	47,296	39,716	(1)	(1)
New York	-	-	405,208	664,602	2,886,085	1,569,884	3,416	910
North Carolina	-	-	-	-	144,275	63,479	32,070	16,035
North Dakota	-	-	-	-	(1)	(1)	67,500	2,500
Ohio	(1)	(1)	788,458	1,445,562	1,653,159	1,186,585	199	60
Oklahoma	(1)	(1)	-	-	190,610	89,776	1,888	3,825
Oregon	-	-	(1)	(1)	316,999	317,682	7,905	28,843
Pennsylvania	(1)	(1)	333,055	570,075	1,663,299	1,479,099	-	-
Puerto Rico	-	-	-	-	-	-	(1)	(1)
Rhode Island	-	-	(1)	(1)	(1)	(1)	-	-
South Carolina	-	-	(1)	(1)	119,706	51,810	-	-
South Dakota	-	-	-	-	84,039	54,457	9,963	2,248
Tennessee	(1)	(1)	166,452	338,204	633,283	569,444	31,141	2,562
Texas	(1)	(1)	(1)	(1)	1,507,735	1,045,946	8,054	11,121
Utah	-	-	(1)	(1)	208,393	124,181	11,458	6,480
Vermont	-	-	-	-	(1)	(1)	-	-
Virginia	(1)	(1)	7,847	4,332	529,582	432,827	63,414	10,980
Washington	-	-	(1)	(1)	615,583	368,968	36,763	19,170
West Virginia	(1)	(1)	(1)	(1)	167,424	165,351	2,820	1,338
Wisconsin	-	-	(1)	(1)	978,320	444,812	13,681	4,862
Wyoming	-	-	-	-	9,216	9,443	81	21
Undistributed [2]	4,405,091	7,799,526	1,918,823	1,811,505	217,587	131,077	97,000	81,000
	4,681,920	8,374,218	7,190,856	9,724,750	30,490,146	18,812,208	1,018,000	428,000

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States and uses—Continued

State	Sand—Continued							
	Paving				Grinding and polishing [3]		Fire or furnace	
	Commercial		Government-and-contractor					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	314,323	$157,969	74,104	$2,562	(1)	(1)	(1)	(1)
Alaska			(1)	(1)				
Arizona	50,673	40,779	3,066	5,006				
Arkansas	209,105	135,435	28,400	8,520				
California	2,379,351	1,395,146	232,396	240,618	64,221	$85,074	(1)	(1)
Colorado	30,528	22,896	13,365	3,665	1,436	1,271		
Connecticut	140,919	94,788	17,313	4,693				
Delaware	12,764	7,658	6,875	4,000	1,449	4,333		
Florida	192,057	114,846						
Georgia	180,410	120,086	270	400	5,196	2,338		
Hawaii								
Idaho	14,922	11,784						
Illinois	637,065	359,568	6,701	4,517	(1)	(1)	66,444	$62,376
Indiana	914,900	557,908	9,192	375			(1)	(1)
Iowa	80,884	48,994	123,203	12,132	(1)	(1)		
Kansas	799,291	455,262	104,234	27,132	3,290	2,229		
Kentucky	207,173	182,779	9,181	3,250				
Louisiana	267,113	203,191	16,940	5,082	(1)	(1)		
Maine	(1)	(1)	93,127	29,933				
Maryland	507,753	376,483	52,863	16,144				
Massachusetts	441,437	248,128	44,493	6,698				
Michigan	883,485	490,918	68,785	15,106	(1)	(1)		
Minnesota	238,389	95,828	92,683	14,997	1,350	750		
Mississippi	170,592	87,443	26,488	6,987	5,239	1,683		
Missouri	353,398	271,656	270	200	(1)	(1)		
Montana	47,548	37,288						
Nebraska	191,437	88,885	380	25	453	181		
Nevada	(1)	(1)	853	495				
New Hampshire	(1)	(1)	338,056	33,927	(1)	(1)		
New Jersey	837,375	346,121	8,602	4,411	(1)	(1)	(1)	(1)
New Mexico	(1)	(1)	(1)	(1)	(1)	(1)		
New York	1,067,885	620,106	100,173	15,953			(1)	(1)
North Carolina	447,647	195,968	812,505	276,660	(1)	(1)		
North Dakota	(1)	(1)	19,152	10,604				
Ohio	1,028,443	721,502	959	693	(1)	(1)	(1)	(1)
Oklahoma	155,916	70,884	1,777	467				
Oregon	230,920	223,209	3,241	1,200	(1)	(1)		
Pennsylvania	884,848	796,813			(1)	(1)	53,446	75,104
Puerto Rico			(1)	(1)				
Rhode Island	(1)	(1)	42,807	20,642				
South Carolina	(1)	(1)	13,844	4,065	(1)	(1)	(1)	(1)
South Dakota	(1)	(1)	61,136	5,571				
Tennessee	296,474	205,811	23,334	18,910	(1)	(1)	(1)	(1)
Texas	1,034,750	664,528	205,406	162,211	(1)	(1)		
Utah	90,906	55,086	129,529	104,759				
Vermont	(1)	(1)	3,325	474				
Virginia	456,884	330,489	91,718	39,447			729	540
Washington	246,470	144,779	187,836	115,388	(1)	(1)		
West Virginia	258,531	234,646	3,053	2,664	(1)	(1)		
Wisconsin	162,454	82,050	112,726	23,501	(1)	(1)		
Wyoming	3,844	10,260	27,419	19,003				
Undistributed [2]	212,657	120,401	2,419,000	725,000	559,877	931,642	188,378	249,852
	16,681,521	10,428,371	5,631,000	1,998,000	642,511	1,029,501	308,997	387,872

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States and uses—Continued

State	Sand—Continued							
	Engine		Filter		Railroad ballast [4]		Other [5]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	102,957	$35,536					4,365	$4,044
Alaska								
Arizona	11,116	9,802					9,000	1,875
Arkansas	(1)	(1)			105	$42		
California	(1)	(1)	9,855	$29,567	30,067	15,220	57,220	112,548
Colorado	47,258	41,836			35,329	13,198	(1)	(1)
Connecticut			5,504	2,372	15,000	12,750	22,267	8,855
Delaware	55,750	23,824	110	276			2,176	1,632
Florida	294	236			(1)	(1)	(1)	(1)
Georgia	17,027	8,406					82,339	51,829
Hawaii								
Idaho							(1)	(1)
Illinois	171,461	99,528	3,022	5,508	342,165	105,825	84,510	116,336
Indiana	172,890	66,546			23,225	7,306	(1)	(1)
Iowa	55,770	44,967	(1)	(1)	(1)	(1)	18,734	13,647
Kansas	121,660	80,512	(1)	(1)	21,872	10,243	16,055	8,619
Kentucky	(1)	(1)					(1)	(1)
Louisiana	13,136	5,763			911	675	(1)	(1)
Maine	(1)	(1)					36,068	13,066
Maryland	(1)	(1)						
Massachusetts	20,607	11,757	(1)	(1)			62,024	20,698
Michigan					(1)	(1)	7,044	2,151
Minnesota	28,475	8,702			58,331	11,774	(1)	(1)
Mississippi	10,908	5,521						
Missouri	52,349	30,207	300	240	136,871	51,002	(1)	(1)
Montana					(1)	(1)	(1)	(1)
Nebraska	143,850	57,243			12,342	3,836	20,455	3,911
Nevada							(1)	(1)
New Hampshire							(1)	(1)
New Jersey	(1)	(1)	(1)	(1)			14,138	33,791
New Mexico	(1)	(1)			6,588	2,440	1,974	1,608
New York	(1)	(1)	20,316	9,470	19,128	8,501	87,995	49,539
North Carolina	(1)	(1)	(1)	(1)	22,016	8,016	(1)	(1)
North Dakota								
Ohio	(1)	(1)	(1)	(1)			78,578	126,789
Oklahoma	90,043	47,508					(1)	(1)
Oregon	(1)	(1)			(1)	(1)	404	430
Pennsylvania	344,687	385,224	7,000	21,000			175,181	259,275
Puerto Rico								
Rhode Island								
South Carolina	(1)	(1)	(1)	(1)			(1)	(1)
South Dakota								
Tennessee	(1)	(1)			5,000	6,000	(1)	(1)
Texas	122,135	65,533	(1)	(1)	(1)	(1)	12,066	11,619
Utah	11,836	7,894	800	480			5,665	1,416
Vermont							4,482	2,733
Virginia	115,260	57,630					(1)	(1)
Washington	(1)	(1)	(1)	(1)			55,522	17,928
West Virginia	390,531	395,144					(1)	(1)
Wisconsin	(1)	(1)			(1)	(1)	16,385	20,658
Wyoming							1,059	679
Undistributed [2]	671,896	435,406	62,938	162,113	353,676	143,934	240,647	231,477
	2,771,896	1,924,725	109,845	231,026	1,082,626	400,762	1,116,353	1,117,153

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States and uses—Continued

State	Gravel							
	Building				Paving			
	Commercial		Government-and-contractor		Commercial		Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	622,329	$506,373	1,350	$1,000	599,098	$411,953	185,102	$15,502
Alaska			(1)	(1)			(1)	(1)
Arizona	156,686	184,576	338	150	51,856	41,901	112,786	29,482
Arkansas	431,473	386,725	27,600	25,875	354,386	319,444	536,060	287,175
California	5,727,516	4,214,569	79,200	22,613	4,294,588	3,281,414	2,016,532	1,427,479
Colorado	278,102	219,251	125,617	138,874	158,666	147,394	696,111	270,759
Connecticut	253,891	212,248	25,920	9,600	159,670	91,702	65,550	24,760
Delaware								
Florida	246,454	291,659	1,500	300	45,640	42,838		
Georgia	33,882	30,043			16,530	12,117	42,525	6,150
Hawaii			(1)	(1)				
Idaho	71,963	59,246	76,250	73,667	264,203	200,420	715,114	381,964
Illinois	2,378,235	1,289,678	14,982	5,894	2,178,471	1,127,966	728,865	473,681
Indiana	802,805	582,319	3,158	3,075	2,198,309	1,416,047	264,180	97,910
Iowa	504,842	438,010	1,350	2,250	1,416,846	611,782	2,761,197	326,099
Kansas	103,869	67,487	7,587	306	612,977	390,195	694,061	305,858
Kentucky	239,390	220,431	9,000	5,400	217,204	198,789	108,175	98,250
Louisiana	825,737	826,842	1,350	1,000	983,687	1,131,548	27,000	2,000
Maine	71,407	87,901			93,554	64,067	1,354,319	429,259
Maryland	771,276	932,765			560,707	590,243	149,565	24,942
Massachusetts	763,575	555,263	675	500	443,154	249,133	227,963	50,772
Michigan	1,457,927	827,256	185,692	40,232	4,183,216	2,231,362	1,984,170	738,726
Minnesota	585,196	501,576	104,794	27,556	656,635	307,891	4,026,479	349,338
Mississippi	337,874	219,319	33,000	29,875	452,253	281,285	230,860	42,730
Missouri	516,775	378,970	35,100	15,500	729,899	463,321	297,956	120,542
Montana	99,460	83,687	(1)	(1)	214,499	177,731	(1)	(1)
Nebraska	636,129	302,159	688	125	2,125,989	1,153,296	298,427	122,736
Nevada	22,074	20,182	55,965	49,785			102,678	41,161
New Hampshire	(1)	(1)			(1)	(1)	605,020	59,885
New Jersey	261,431	256,565			367,755	263,971	12,308	1,000
New Mexico	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
New York	1,154,480	933,326	64,530	3,155	1,157,065	980,764	351,053	42,618
North Carolina	107,971	136,293	16,555	13,020	431,974	532,737	273,758	146,419
North Dakota	61,200	52,121	19,740	731	92,096	56,933	940,823	133,056
Ohio	1,189,865	936,680			2,270,364	1,539,052	301,416	96,945
Oklahoma	128,019	84,814	85	262	122,156	106,173	418,231	36,253
Oregon	558,961	505,015	43,972	51,306	1,536,147	1,241,926	927,573	871,028
Pennsylvania	1,314,465	1,077,041	406	15	912,497	761,117	68,711	13,188
Puerto Rico			(1)	(1)			(1)	(1)
Rhode Island	(1)	(1)			(1)	(1)	18,937	1,627
South Carolina	9,600	4,800					11,219	2,469
South Dakota	22,893	25,089	122,909	28,851	107,920	43,147	1,693,942	758,831
Tennessee	392,355	397,038	163,067	149,010	603,596	457,517	470,246	167,013
Texas	1,594,179	1,398,788	8,630	7,942	2,487,502	2,170,940	1,199,625	404,773
Utah	292,343	173,750	77,106	34,973	243,599	146,730	960,043	573,245
Vermont	(1)	(1)	135	200	(1)	(1)	21,613	6,623
Virginia	595,648	825,712	161,546	38,870	592,324	692,300	199,062	30,009
Washington	969,865	577,580	140,957	88,496	652,131	437,778	2,280,622	1,190,558
West Virginia	192,995	192,542	34,507	16,081	356,690	336,039	89,088	57,326
Wisconsin	837,343	476,323	385,375	217,675	1,518,440	767,227	2,586,798	975,345
Wyoming	22,771	20,176	217	47	115,887	95,479	400,819	196,859
Undistributed [2]	264,791	223,366	114,000	120,000	178,984	120,325	3,136,000	3,332,000
	27,910,042	21,735,554	2,145,000	1,225,000	36,759,164	25,693,994	34,592,000	14,764,000

See footnotes at end of table.

Sand and gravel sold or used by commercial and Government-and-contractor producers in the United States in 1945, by States and uses—Continued

State	Gravel—Continued				Sand and gravel			
	Railroad ballast [6]		Other [7]		Total commercial		Total Government-and-contractor	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	26,840	$8,052	69,233	$55,703	2,281,213	$1,561,623	260,556	$19,064
Alaska	----	----	----	----	(1)	(1)	(1)	(1)
Arizona	860	817	1,719	1,633	411,869	408,321	116,190	34,638
Arkansas	598,682	221,006	(1)	(1)	2,096,562	1,609,210	592,060	321,570
California	683,499	271,805	239,631	64,273	19,242,696	13,462,980	2,357,254	1,713,279
Colorado	57,253	46,183	----	----	901,207	650,955	899,198	496,072
Connecticut	84,181	70,470	(1)	(1)	1,093,793	773,267	517,423	68,242
Delaware	----	----	----	----	75,799	39,678	6,875	4,000
Florida	25,835	24,585	----	----	1,312,511	1,073,755	1,500	300
Georgia	11,020	8,078	----	----	561,296	342,314	43,740	7,950
Hawaii	----	----	----	----	----	----	(1)	(1)
Idaho	328,778	111,586	(1)	(1)	761,741	451,268	835,371	501,703
Illinois	1,657,816	621,337	18,624	13,829	11,863,007	8,122,063	750,548	484,092
Indiana	1,166,287	572,283	48,997	34,903	6,671,428	4,014,482	276,530	101,360
Iowa	286,805	75,861	34,748	59,543	3,144,631	1,750,310	2,885,900	341,081
Kansas	11,617	15,629	(1)	(1)	2,262,685	1,338,544	819,707	336,198
Kentucky	----	----	(1)	(1)	1,048,154	926,524	126,356	106,900
Louisiana	141,116	77,409	(1)	(1)	2,752,281	2,577,863	45,290	8,082
Maine	55,557	19,387	109,542	86,122	441,332	312,532	1,447,446	459,192
Maryland	----	----	7,620	7,620	2,696,380	2,653,790	202,428	41,086
Massachusetts	45,640	18,264	53,621	21,581	2,655,154	1,638,317	273,266	58,070
Michigan	577,306	304,322	(1)	(1)	9,958,909	5,313,574	2,241,068	794,316
Minnesota	1,909,423	566,029	330,529	66,477	4,871,098	1,992,068	4,254,019	410,462
Mississippi	172,593	53,012	----	----	1,315,997	732,454	290,348	79,592
Missouri	241,008	145,139	14,750	11,600	3,156,449	2,644,225	333,326	136,242
Montana	1,491,717	670,939	(1)	(1)	2,035,192	1,067,295	(1)	(1)
Nebraska	684	376	(1)	(1)	3,582,966	1,833,674	299,495	122,886
Nevada	591,895	349,994	(1)	(1)	803,985	790,862	195,796	123,614
New Hampshire	----	----	----	----	(1)	(1)	943,076	93,812
New Jersey	(1)	(1)	22,159	39,085	4,485,334	4,647,377	21,045	5,561
New Mexico	127,051	68,378	----	----	448,438	317,968	(1)	(1)
New York	----	----	77,976	96,754	6,958,456	4,987,269	519,172	62,636
North Carolina	(1)	(1)	(1)	(1)	1,259,201	1,065,069	1,134,888	452,134
North Dakota	450,028	218,932	59,351	9,560	721,871	376,272	1,047,215	146,891
Ohio	1,516,228	786,260	169,517	239,512	9,117,806	7,887,320	302,574	97,698
Oklahoma	10,892	6,535	----	----	852,205	720,641	421,981	40,807
Oregon	782,232	412,403	32,890	6,725	3,493,813	2,728,878	982,691	952,377
Pennsylvania	27,000	13,500	18,194	19,405	6,699,827	7,234,410	69,117	13,203
Puerto Rico	----	----	----	----	----	----	(1)	(1)
Rhode Island	----	----	----	----	255,556	199,361	61,744	22,169
South Carolina	51,176	69,088	----	----	294,870	195,801	25,063	6,534
South Dakota	476,137	169,025	(1)	(1)	754,544	311,482	1,887,950	795,501
Tennessee	214,278	137,939	21,048	21,008	2,409,838	2,240,884	687,788	337,495
Texas	2,733,839	1,469,477	(1)	(1)	9,616,529	7,009,857	1,421,715	586,047
Utah	111,830	49,688	(1)	(1)	969,774	561,121	1,178,136	719,457
Vermont	3,817	1,114	3,640	1,391	109,904	53,875	25,073	7,297
Virginia	109,656	193,090	1,585	2,377	2,449,530	2,602,045	515,740	119,306
Washington	1,557,480	806,940	163,355	58,173	4,303,631	2,459,021	2,646,178	1,413,612
West Virginia	(1)	(1)	(1)	(1)	2,372,305	3,245,880	129,468	77,409
Wisconsin	1,185,433	339,321	46,484	27,925	5,285,699	2,889,899	3,098,580	1,221,383
Wyoming	921,351	339,222	38,705	2,050	1,112,833	477,309	428,536	215,930
Undistributed [2]	213,142	184,853	150,521	96,661	167,999	128,685	5,766,000	4,258,000
	20,657,982	9,518,328	1,734,439	1,043,910	152,138,298	110,422,372	43,386,000	18,415,000

[1] Included under "Undistributed."
[2] Includes items entered as "1."
[3] Includes 318,390 tons of blast sand valued at $766,013.
[4] Includes 17,792 tons of ballast sand valued at $2,429, produced by railroads for their own use.
[5] Includes 220,244 tons of sand valued at $44,356, used by railroads for fills and similar purposes.
[6] Includes 8,587,465 tons of ballast gravel valued at $2,987,940, produced by railroads for their own use.
[7] Includes 843,969 tons of gravel valued at $133,494, used by railroads for fills and similar purposes.

Government-and-contractor production.—As shown in the accompanying chart, output of sand and gravel from "noncommercial" or Government-and-contractor operations accounted for nearly half the total tonnage in 1939. By 1942 it had declined to less than a quarter and in 1945 it was only 22 percent of the total production.

States reported 37 percent of the total in 1945, counties 44, municipalities 3, and other agencies 16.

In 1945 contractors furnished 32 percent of the Government-and-contractor tonnage, which compares with 56 percent in 1943. The average value increased 5 cents per ton in 1945.

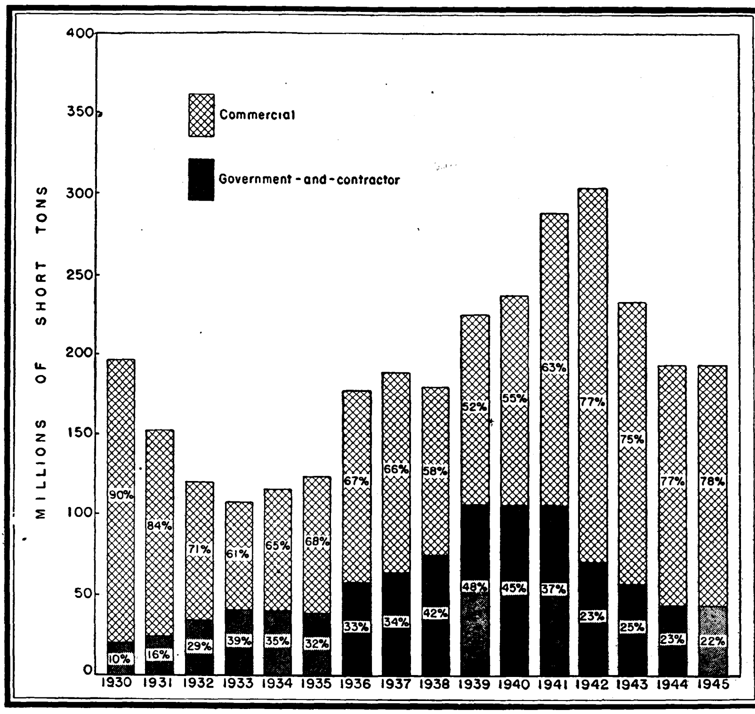

FIGURE 2.—Sand and gravel sold or used in the United States by commercial and Government-and-contractor producers, 1930–45.

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1941–45, by uses

Year	Sand				Gravel				Total Government-and-contractor sand and gravel	
	Building		Paving		Building		Paving			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
		Dollars		*Dollars*		*Dollars*		*Dollars*		*Dollars*
1941	5,789,000	1,797,000	12,876,000	4,013,000	8,779,000	3,797,000	79,715,000	22,893,000	107,159,000	32,500,000
1942	3,482,000	2,018,000	5,089,000	2,109,000	8,022,000	3,942,000	54,806,000	21,004,000	71,399,000	29,073,000
1943	3,187,000	1,757,000	4,584,000	2,267,000	4,106,000	2,803,000	45,718,000	18,064,000	57,595,000	24,891,000
1944	856,000	474,000	4,592,000	1,431,000	2,663,000	1,626,000	36,039,000	12,837,000	44,150,000	16,368,000
1945	1,018,000	428,000	5,631,000	1,998,000	2,145,000	1,225,000	34,592,000	14,764,000	43,386,000	18,415,000

Sand and gravel sold or used by Government-and-contractor producers in the United States, 1942–45, by types of producers

Type of producer	1942		1943		1944		1945	
	Short tons	Average value per ton	Short tons	Average value per ton	Short tons	Average value per ton	Short tons	Average value per ton
Construction and maintenance crews	36,911,000	$0.29	25,348,000	$0.31	27,889,000	$0.29	29,353,000	$0.31
Contractors	34,488,000	.53	32,247,000	.53	16,261,000	.50	14,033,000	.67
	71,399,000	.41	57,595,000	.43	44,150,000	.37	43,386,000	.42
States	23,334,000	.31	18,076,000	.42	18,775,000	.40	15,944,000	.44
Counties	18,841,000	.21	14,504,000	.27	18,421,000	.27	19,126,000	.28
Municipalities	1,397,000	.29	1,191,000	.32	1,227,000	.37	1,155,000	.30
Other agencies	27,827,000	.63	23,824,000	.54	5,727,000	.59	7,161,000	.73
	71,399,000	.41	57,595,000	.43	44,150,000	.37	43,386,000	.42

METHOD OF TRANSPORTATION

As more tires, trucks, and repair parts became available in 1945 and railroad cars were often scarce, a greater proportion of sand and gravel shipments moved by truck. Waterways handle a minor portion of the national total, but in some areas they are dominant. As shown in the accompanying table, trucks and railroads handle nearly equal tonnages from the commercial plants; but, taking Government-and-contractor output into consideration, truck transportation dominates the industry as a whole.

Sand and gravel sold or used by commercial producers in the United States, 1944–45, by methods of transportation [1]

Method of transportation	1944		1945	
	Short tons	Percent of total reported	Short tons	Percent of total reported
Truck	58,210,087	42.4	61,439,488	43.5
Rail	68,899,663	50.1	69,456,386	49.2
Waterway	10,359,959	7.5	10,389,771	7.3
Total reported	137,469,709	100.0	141,285,645	100.0
Percent of total commercial production covered		91.0		92.9

[1] For practical purposes the entire output of Government-and-contractor operations commonly is moved by truck. Including Government-and-contractor production, sand and gravel moved as follows—1944: Truck 56 percent, rail 38 percent, and waterway 6 percent; 1945: truck 57 percent, rail 37 percent, and waterway 6 percent.

DEGREE OF PREPARATION

Whereas Government-and-contractor sand and gravel commonly includes a high proportion of unprepared material, the reverse is true of commercial plants. As preparation adds substantially to production costs commercial output has a higher average value. The accompanying table shows this relationship in the past 2 years. Of the total sand and gravel production in 1945, 71 percent was classified as prepared.

Sand and gravel (prepared or unprepared) sold or used by producers in the United States, 1944–45, by commercial and Government-and-contractor operations

	1944			1945		
	Quantity		Average value per ton	Quantity		Average value per ton
	Short tons	Percent		Short tons	Percent	
Commercial operations:						
Prepared	128, 326, 430	85	$0. 77	129, 731, 535	85	$0. 77
Unprepared	22, 306, 651	15	. 43	22, 406, 763	15	. 46
	150, 633, 081	100	. 72	152, 138, 298	100	. 73
Government-and-contractor operations:						
Prepared	9, 150, 000	21	. 62	8, 434, 000	19	. 85
Unprepared	35, 000, 000	79	. 31	34, 952, 000	81	. 32
	44, 150, 000	100	. 37	43, 386, 000	100	. 42
Grand total	194, 783, 000		. 64	195, 524, 000		. 66

SIZE OF PLANTS

After reaching 87,000 tons in 1942, the average plant output declined to 62,000 tons in 1944—almost as low as before the war. In 1945 average plant production increased to 68,000 tons. The plants producing over 500,000 tons decreased from 30 to 28 and supplied only 15.2 percent of the tonnage as compared with 17.1 percent in 1944; but, as shown in the accompanying table, the contributions of the small plants (less than 25,000 tons) also decreased. However, the middle-size plants, producing 50,000 to 400,000 tons, increased in number. Details of output, by size groups, are given in the following table.

Comparison of number and output of commercial sand and gravel plants in the United States, 1944–45, by size groups [1]

Size group, in short tons	1944				1945			
	Plants [2]		Production		Plants [2]		Production	
	Number	Percent of total	Short tons	Percent of total	Number	Percent of total	Short tons	Percent of total
Less than 25,000	1, 148	51. 1	9, 931, 000	7. 1	1, 001	47. 6	9, 345, 000	6. 6
25,000 and less than 50,000	415	18. 5	15, 001, 000	10. 7	370	17. 6	13, 394, 000	9. 4
50,000 and less than 100,000	297	13. 2	21, 050, 000	15. 1	328	15. 6	23, 219, 000	16. 3
100,000 and less than 200,000	225	10. 0	31, 157, 000	22. 3	238	11. 3	33, 590, 000	23. 6
200,000 and less than 300,000	77	3. 4	18, 466, 000	13. 2	78	3. 7	19, 089, 000	13. 4
300,000 and less than 400,000	37	1. 7	12, 583, 000	9. 0	44	2. 1	15, 039, 000	10. 6
400,000 and less than 500,000	17	. 8	7, 610, 000	5. 5	16	. 8	7, 023, 000	4. 9
500,000 and less than 600,000	10	. 4	5, 418, 000	3. 9	9	. 5	4, 731, 000	3. 3
600,000 and less than 700,000	7	. 3	4, 517, 000	3. 2	6	. 3	3, 909, 000	2. 7
700,000 and less than 800,000	4	. 2	2, 856, 000	2. 1	3	. 1	2, 206, 000	1. 5
800,000 and less than 900,000 } 900,000 and less than 1,000,000 }	4	. 2	3, 547, 000	2. 5	3	. 1	2, 520, 000	1. 8
					3	. 1	2, 800, 000	2. 0
1,000,000 and over	5	. 2	7, 466, 000	5. 4	4	. 2	5, 604, 000	3. 9
	2, 246	100. 0	139, 602, 000	100. 0	2, 103	100. 0	142, 469, 000	100. 0

[1] Plants operated by or for States, counties, municipalities, and other Government agencies are not included; also not included are approximately 180 railroad plants with an output of 11,031,000 tons of sand and gravel in 1944 and 165 plants with an output of 9,669,000 tons in 1945.
[2] Includes a few companies operating more than 1 plant but not submitting separate returns for individual plants.

PRINCIPAL TRENDS

Sand and gravel for construction.—When hostilities ended the demand for home and other building construction, accumulated during the war and the depression, made itself felt. As this demand

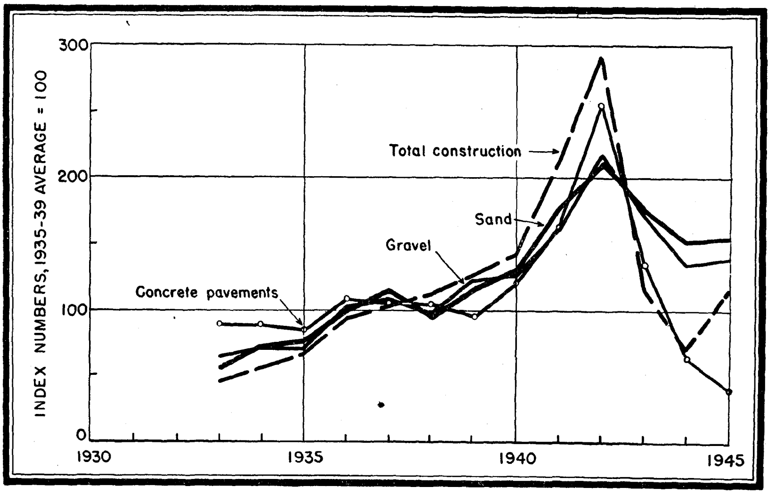

FIGURE 3.—Value of sand and gravel production compared with total construction (contract awards, value) and concrete pavements (contract awards, thousands of square yards) in the United States 1933-45. Data on construction and concrete pavements from Bureau of Foreign and Domestic Commerce.

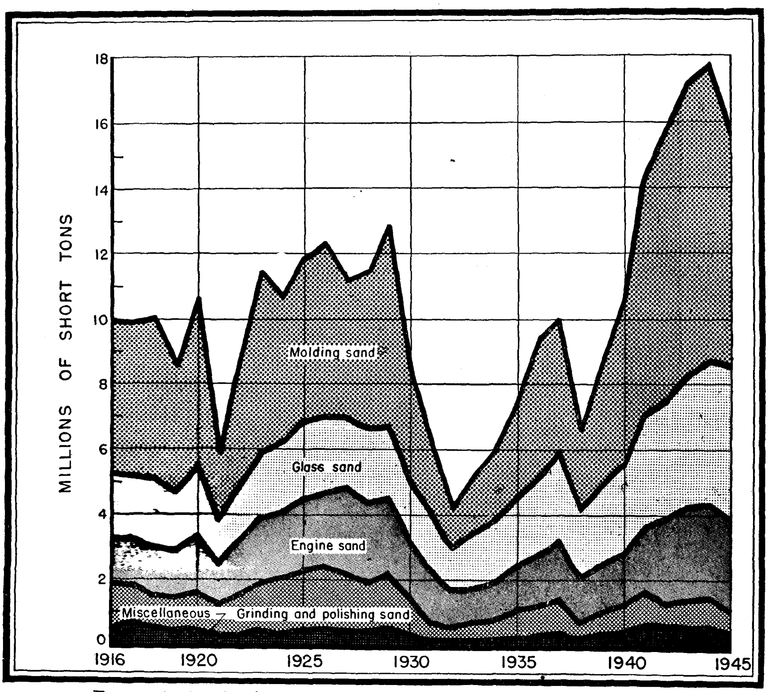

FIGURE 4.—Production of industrial sands in the United States, 1916-45.

is supported by substantial private savings and easy credit, it should continue at a high level for a number of years. Similarly, highway construction has been neglected during the war and is likely to increase substantially as public funds are made available.

Industrial sands.—Although output of most industrial sands declined considerably in 1945 owing to reconversion problems, their prospects are far from dark. Their volume depends upon the level of industrial production; and, barring major financial dislocation, industry is likely to be busy in the immediate future producing goods that are now in great demand.

EMPLOYMENT AND PRODUCTIVITY

Although more men became available in the latter half of the year, manpower was scarce in 1945. Total employment declined to an average of somewhat less than 22,000 men. As shown in the following table the average number of hours worked per day also decreased, and productivity improved.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States, 1939–45 [1]

Year	Employment					Production (short tons)			Percent of commercial industry represented
	Average number of men	Time employed				Commercial sand and gravel	Average per man		
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
1939	15,617	214	3,335,321	8.4	28,054,960	96,755,364	29.0	3.5	81.7
1940	16,595	217	3,596,886	8.4	30,263,744	101,143,305	28.1	3.3	77.1
1941	19,909	228	4,530,488	8.6	38,978,128	144,594,925	31.9	3.7	79.6
1942	25,061	227	5,679,695	8.9	50,694,303	183,255,772	32.3	3.6	78.7
1943	20,308	234	4,743,721	8.9	42,041,878	138,113,786	29.1	3.3	78.3
1944	17,777	228	4,055,192	9.0	36,584,540	120,968,395	29.8	3.3	80.3
1945	16,528	233	3,857,671	8.7	33,745,368	116,632,047	30.2	3.5	76.7

[1] Excludes plants operated by or directly for States, counties, municipalities, and other Government agencies.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States, 1944–45, by regions [1]

Region	Employment					Production (short tons)			
	Average number of men	Time employed				Commercial sand and gravel	Average per man		Percent of commercial industry represented
		Average number of days	Total man-shifts	Man-hours			Per shift	Per hour	
				Average per man per day	Total				
Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, and Connecticut	579	184	106, 349	8.7	926, 994	3, 504, 811	33.0	3.8	80.2
New York	820	201	164, 812	8.4	1, 383, 794	5, 068, 335	30.8	3.7	82.3
Pennsylvania, New Jersey, and Delaware	2, 149	255	547, 443	8.8	4, 792, 563	11, 238, 735	20.5	2.3	98.2
West Virginia, Virginia, Maryland, and District of Columbia	1, 249	270	337, 827	9.2	3, 099, 575	6, 091, 241	18.0	2.0	74.4
South Carolina, Georgia, Alabama, Florida, and Mississippi	764	258	197, 150	8.8	1, 740, 099	4, 539, 155	23.0	2.6	86.3
North Carolina, Kentucky, and Tennessee	907	258	234, 342	9.2	2, 150, 584	4, 318, 487	18.4	2.0	92.5
Arkansas, Louisiana, and Texas	1, 711	246	420, 664	9.6	4, 019, 899	9, 707, 085	23.1	2.4	74.4
Ohio	1, 721	212	365, 339	8.6	3, 125, 603	8, 591, 305	23.5	2.7	85.9
Illinois and Indiana	1, 600	213	340, 005	10.4	3, 519, 237	14, 835, 695	43.6	4.2	82.1
Michigan and Wisconsin	1, 512	189	286, 358	9.1	2, 609, 905	13, 169, 893	46.0	5.0	87.0
North Dakota, South Dakota, and Minnesota	305	159	48, 423	8.9	431, 646	2, 177, 281	45.0	5.0	38.1
Nebraska and Iowa	765	183	139, 836	10.0	1, 396, 950	5, 400, 907	38.6	3.9	80.5
Kansas, Missouri, and Oklahoma	821	242	198, 685	8.8	1, 750, 769	5, 231, 482	26.3	3.0	91.4
Wyoming, Colorado, New Mexico, Utah, and Arizona	374	187	70, 028	8.4	587, 647	2, 403, 181	34.3	4.1	61.8
California and Nevada	1, 654	261	431, 618	8.4	3, 644, 137	18, 729, 742	43.4	5.1	89.5
Montana, Washington, Oregon, and Idaho	846	197	166, 313	8.4	1, 405, 138	5, 961, 060	35.8	4.2	52.7
Total United States	17, 777	228	4, 055, 192	9.0	36, 584, 540	120, 968, 395	29.8	3.3	80.3
1945									
Maine, New Hampshire, Vermont, Rhode Island, Massachusetts, and Connecticut	595	203	120, 814	8.7	1, 045, 435	4, 211, 648	34.9	4.0	89.2
New York	870	193	167, 673	8.2	1, 382, 469	5, 474, 550	32.7	4.0	78.7
Pennsylvania, New Jersey, and Delaware	1, 957	267	522, 127	8.5	4, 441, 397	11, 104, 018	21.3	2.5	98.6
West Virginia, Virginia, Maryland, and District of Columbia	1, 024	281	287, 315	8.8	2, 540, 562	4, 911, 236	17.1	1.9	65.3
South Carolina, Georgia, Alabama, Florida, and Mississippi	703	263	185, 105	9.1	1, 678, 303	5, 044, 553	27.3	3.0	87.5
North Carolina, Kentucky, and Tennessee	925	251	232, 552	9.4	2, 195, 201	4, 301, 116	18.5	2.0	91.2
Arkansas, Louisiana, and Texas	1, 515	256	388, 195	9.4	3, 644, 615	9, 815, 156	25.3	2.7	67.9
Ohio	1, 345	211	284, 102	8.4	2, 387, 009	6, 429, 464	22.6	2.7	70.5
Illinois and Indiana	1, 599	233	372, 770	8.4	3, 120, 323	15, 249, 499	40.9	4.9	82.3
Michigan and Wisconsin	1, 409	205	289, 362	9.1	2, 633, 534	11, 741, 367	40.6	4.5	77.0
North Dakota, South Dakota, and Minnesota	387	159	61, 658	9.0	555, 036	2, 500, 690	40.6	4.5	39.4
Nebraska and Iowa	512	166	85, 102	9.4	800, 088	3, 334, 550	39.2	4.2	49.6
Kansas, Missouri, and Oklahoma	721	238	171, 356	8.9	1, 529, 105	5, 333, 891	31.1	3.5	85.1

See footnote at end of table.

Employment in the commercial sand and gravel industry, sand and gravel produced at plants included in the study, and average output per man in the United States, 1944–45, by regions [1]—Continued

Region	Employment					Production (short tons)			
	Average number of men	Time employed				Commercial sand and gravel	Average per man		Percent of commercial industry represented
		Average number of days	Total man-shifts	Man-hours					
				Average per man per day	Total		Per shift	Per hour	
1945—Continued									
Wyoming, Colorado, New Mexico, Utah, and Arizona	362	210	76, 165	8. 3	630, 618	2, 627, 280	34. 5	4. 2	68. 3
California and Nevada	1, 671	263	439, 139	8. 5	3, 727, 354	17, 477, 680	39. 8	4. 7	87. 2
Montana, Washington, Oregon, and Idaho	933	187	174, 236	8. 2	1, 434, 319	7, 075, 349	40. 6	4. 9	66. 8
Total United States	16, 528	233	3, 857, 671	8. 7	33, 745, 368	116, 632, 047	30. 2	3. 5	76. 7

[1] Excludes plants operated by or directly for States, counties, municipalities, and other Government agencies.

PRICES

In 1945 the average value, reflecting the rise in labor and other costs, increased for most classes of sand and gravel. However, the rise was a comparatively modest 3.1 percent for the whole, and for commercial plants it averaged only 1.4 percent. Details of valuation are shown in the summary table at the beginning of this chapter. Sand and gravel prices were controlled by the provisions of Maximum Price Regulation 188 of the Office of Price Administration.

NEW DEVELOPMENTS

Although it is difficult to point out any spectacular technical developments in 1945, progress was being made. Plants that had been overworked during the years of record production needed rehabilitation. In renewing their equipment, many operators were incorporating improvements of all kinds that have become available in recent years. This will raise the general level of efficiency and quality and enable producers to meet the trend toward increasingly stringent specifications. For example, trade journals published descriptions of installations designed to deliver a product containing more fines.[1 2 3]

The widespread demand for more fines in concrete aggregates led to a Nation-wide study of past grading analyses by the National Sand and Gravel Association. This showed that 61 percent of the 214 sources had less than 2 percent of minus 100-mesh material in their product and 90 percent had less than 3½ percent. With speci-

[1] Houdyshell, R. D., Topeka Firm Has Novel System for Mixing and Delivering Fines: Pit and Quarry, vol. 38, No. 6, December 1945, p. 70.
[2] Warner, Irving, Retaining Fines in Concrete Sand: Rock Products, vol. 7, No. 1, January 1946, pp. 14–16.
[3] Rock Products, Long Settling Flume Recovers Fines: vol. 49, No. 4, April 1946, p. 82.

fications of over 2 percent becoming routine, the majority of sand producers are finding it necessary to modify their practice.

Geophysical exploration for gravel deposits is not common, but sometimes it may be effective and inexpensive. A paper outlining use of earth resistivity method by the Public Roads Administration was published in 1945.[4]

FOREIGN TRADE

Imports of sand and gravel are small when compared with the total domestic production—0.14 percent in 1945; however, the tonnage is relatively large. The accompanying table shows imports during the past 10 years. In 1945 Canada furnished 200,280 short tons of sand valued at $126,097 and 78,863 tons of gravel worth $42,015. The United Kingdom and Bermuda furnished less than 1 ton each. Exports are not now separately classified by the United States Department of Commerce, but before 1939 they ranged from 25,000 to 100,000 tons a year.

Sand and gravel imported for consumption in the United States, 1936–45, by classes

Year	Sand				Gravel		Total	
	Glass sand [1]		Other sand [2]					
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1936	52,944	$117,706	124,013	$62,193	201,398	$38,142	378,355	$218,041
1937	51,090	79,112	319,134	134,430	163,406	36,193	533,630	249,735
1938	33,889	68,315	611,468	157,992	55,619	22,902	700,976	249,209
1939	23,690	33,604	192,106	79,272	60,147	8,399	275,943	121,275
1940	4,337	8,722	264,170	90,350	175,558	25,686	444,065	124,758
1941	---	---	263,389	105,088	164,175	26,132	427,564	131,220
1942	(3)	5	408,825	297,122	146,116	60,389	554,941	357,516
1943	18	363	296,262	206,145	86,924	63,381	383,204	269,889
1944	15	181	209,255	129,632	67,929	31,208	277,199	161,021
1945	(3)	148	200,280	126,102	78,863	42,015	279,143	168,265

[1] Classification reads "Sand containing 95 percent silica and not more than 0.6 percent oxide of iron and suitable for manufacture of glass."
[2] Classification reads "Sand, n. s. p. f."
[3] Less than 1 ton.

BLAST-FURNACE SLAG

In 1945 output of commercialized blast-furnace slag totaled 12,635,868 tons, 2 percent more than the 12,405,992 tons reported in 1944. Sales of air-cooled slag increased 3 percent. These statistics are based on a canvass, conducted by the National Slag Association, of the 32 companies that prepared blast-furnace slag for commercial use.

Practically all of the commercial production is east of the Mississippi River, chiefly at steel centers in Ohio, Alabama, Pennsylvania, and Illinois. Shipments, however, are made into all States east of the Mississippi except some of the New England States outside the economic range of sources of supply. Shipments of slag are made by rail-

[4] Moore, W., Prospecting for Gravel Deposits by Resistivity Methods: Pit and Quarry, vol. 38, No. 3, September 1945, pp. 77-80.

road, truck, and waterway. The accompanying tabulations show the pattern of distribution during the past 4 years.

The average shipping range of blast-furnace slag in 1945 was 63 miles by rail, 15 by truck, and 125 by waterway. In most instances shipments did not exceed 100 miles by railroad, 30 by truck, and 250 by waterway.

Shipments of commercial slag in the United States, 1941–45, by methods of transportation [1]

[Percent of total]

Method of transportation	1941	1942	1943	1944	1945
Rail	55	52	56	56	67
Truck	43	47	44	44	33
Waterway	2	1	(2)	(2)	(2)

[1] National Slag Association. [2] Less than 0.5 percent.

Details of the tonnage and value of slag consumed in the various uses are shown in an accompanying table. An outstanding development is the increased production of lightweight slag for use in building construction. To service the seemingly insatiable demand for building materials in the latter part of 1945, installation of concrete-block plants reached a record rate. As they began to operate, demand for aggregates grew in proportion. Tests and experience both in this country and in Europe indicate that properly expanded slag is particularly valuable for this use. Most foamed slag is produced with the Brosius and Caldwell machines in the United States, but other methods are under investigation also.

In 1945, slag processors reported that 158,186 tons of iron were recovered—approximately 24 pounds per ton of slag handled.

Not including those assigned to administrative, office, and sales activities, 1,414 plant and yard employees were engaged in the production of commercial slag in 1945.

Air-cooled blast-furnace slag sold or used by producers in the United States, 1944–45, by States [1]

	1944			1945		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Alabama	3,089,075	26.8	$2,152,315	3,417,471	28.9	$2,570,830
Ohio	2,920,145	25.4	2,764,467	3,857,046	32.6	2,951,418
Pennsylvania	1,426,247	12.4	1,466,322	1,396,733	11.8	1,454,479
Other States [2]	4,071,448	35.4	3,180,613	3,163,214	26.7	3,005,613
	11,506,915	100.0	9,563,717	11,834,464	100.0	9,982,340

[1] National Slag Association.
[2] Illinois, New York, Maryland, Michigan, West Virginia, Kentucky, Colorado, Tennessee, and Massachusetts.

Blast-furnace slag sold or used by producers in the United States in 1945, by uses [1]

Use	Air-cooled						Granulated			Lightweight		
	Screened			Unscreened								
	Short tons	Value		Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton		Total	Average per ton
Concrete pavements and structures	944, 976	$830, 399	$0. 88									
Roads other than concrete	5, 464, 432	5, 052, 266	. 92	142, 656	$57, 649	$0. 40	217, 476	$57, 211	$0. 26			
Railroad ballast	3, 369, 483	2, 279, 474	. 68	62, 538	20, 761	. 33						
Airport runways	551, 007	531, 595	. 96									
Mineral wool	399, 932	405, 692	1. 01									
Roofing slag	219, 019	294, 361	1. 34									
Sewage trickle filter	13, 779	16, 543	1. 20									
Agricultural slag	38, 067	39, 833	1. 05				27, 117	23, 738	. 88			
Cement manufacture							322, 704	51, 632	. 16			
Concrete products	132, 325	122, 201	. 92							234, 107	$335, 931	$1. 43
Other uses	294, 669	269, 449	. 91	201, 581	62, 117	. 31						
Total: 1945	11, 427, 689	9, 841, 813	. 86	406, 775	140, 527	. 35	567, 297	132, 581	. 23	234, 107	335, 931	1. 43
1944	10, 730, 613	9, 260, 257	. 86	776, 302	303, 460	. 39	733, 255	133, 308	. 18	165, 822	232, 508	1. 40
1943	13, 736, 642	11, 714, 225	. 85	1, 364, 779	540, 465	. 40	1, 329, 215	319, 421	. 24	76, 971	112, 817	1. 47
1942	13, 591, 896	11, 832, 670	. 87	2, 073, 611	884, 178	. 43	3, 457, 211	587, 094	. 17			
1941	12, 372, 218	10, 434, 187	. 84	797, 363	390, 082	. 49	1, 508, 685	239, 833	. 16			
1940	8, 132, 396	7, 015, 616	. 86	1, 230, 832	507, 288	. 41	989, 814	257, 737	. 26			
1939	7, 108, 061	5, 870, 582	. 83	812, 220	361, 554	. 45	1, 188, 094	122, 017	. 10			
1938	6, 118, 505	5, 600, 668	. 92	1, 202, 754	567, 224	. 47	656, 807	78, 723	. 12			

[1] National Slag Association.

GYPSUM

By Charles L. Harness and M. G. Downey

SUMMARY OUTLINE

SUMMARY

Despite price difficulties and shortages of labor and materials, the gypsum industry as a whole recovered in 1945 from the wartime low of 1944. Small increases were recorded for both mined and calcined gypsum, the generally accepted barometers of the industry. Receipts of Canadian gypsum, for use in plaster and wallboard plants on the Atlantic seaboard and for peanut fertilizer in the Southeast, were the highest since 1941, although still much below prewar levels. Sales of most gypsum building products showed increases, although sales of some low-profit items (including lath) and temporary structural materials (sheathing and laminated board) declined.

When the War Production Board on October 15, 1945, abolished Conservation Order L-41, which had controlled construction since April 1942, rapid improvement in the availability of most construction items was expected. These expectations were not borne out. Accordingly, the Civilian Production Administration issued Priorities Regulation 33 on December 20, 1945, effective January 15, 1946, requiring that dealers in construction materials set aside certain percentages of their sales for veterans and low-cost reconversion housing. The commodities affected included gypsum board and lath. The CPA estimated that the material set aside would be adequate for 400,000 dwelling units and that the remainder would supply the needs of 100,000 additional units. That some such action in the case of gypsum board was necessary is shown by the gradual increase in producers' unfilled orders, which amounted on January 1, 1945, to about 30 days' production but by the end of 1945 had increased to 3 or 4 months' production.

It soon became apparent that the construction industry would require additional assistance and that the 500,000 houses originally aimed at by Priorities Regulation 33 were inadequate. A bill (H. R. 4761) was introduced in Congress to amend the National Housing Act, placing wide powers of price control and priorities under the control of the National Housing Administration. Under the system of controls provided in the bill, Housing Expediter Wilson W. Wyatt proposed to allocate construction materials to 700,000 conventional houses, 250,000 temporary units, and 250,000 permanent prefabricated houses in 1946, followed by 600,000 prefabricated houses and 900,000 conventional houses in 1947.

Salient statistics of the gypsum industry in the United States, 1941–45

	1941	1942	1943	1944	1945
Active establishments [1]	93	90	85	77	75
Crude gypsum [2]—					
Mined .... short tons	4,788,534	4,697,568	3,877,541	3,761,234	3,811,723
Imported .... do	1,347,957	394,460	231,323	342,462	508,762
Apparent supply .... do	6,136,491	5,092,028	4,108,864	4,103,696	4,320,485
Calcined gypsum produced: [3]					
Short tons	3,980,567	3,045,082	2,557,730	2,363,143	2,485,090
Value	$19,746,914	$16,403,068	$14,751,587	$13,841,399	$14,473,566
Gypsum products sold: [3]					
Uncalcined uses:					
Short tons	1,320,713	1,514,913	1,233,727	1,056,276	1,147,797
Value	$3,138,958	$3,533,607	$3,114,789	$2,953,564	$3,432,727
Industrial uses:					
Short tons	151,960	142,705	163,500	200,473	157,796
Value	$1,885,313	$1,840,927	$2,258,981	$2,550,649	$2,326,363
Building uses:					
Value	$64,734,171	$57,796,210	$53,722,762	$50,196,006	$54,389,504
Total value	$69,758,442	$63,170,744	$59,096,532	$55,700,219	$60,148,594
Gypsum and gypsum products—					
Imported for consumption	$1,282,140	$508,321	$304,154	$394,603	$548,697
Exported	$529,574	$977,863	$283,720	$489,980	$1,502,668

[1] Each mine, plant, or combination mine and plant is counted as 1 establishment.
[2] Excludes byproduct gypsum.
[3] Made from domestic, imported, and byproduct crude gypsum.

The United States Department of Commerce [1] estimated that 2,101 million square feet of gypsum board (including lath) would be required for the 1,200,000 houses contemplated for 1946 and that 3,431 million square feet would be needed for all construction during 1946.

H. R. 4761 passed the House of Representatives March 7, 1946, and the Senate in amended form April 10. A conference, to follow reconvening of the House on April 30, was agreed on by both Houses of Congress.

The bill provided for subsidies to encourage production of construction materials whenever necessary and to assist financially the installation of new production capacity. In view of the new and enlarged board mill capacity under construction in many parts of the country during 1945 and 1946 there is some doubt as to whether further development will be needed.

In early 1945 the gypsum products industry experienced the severest labor shortage in its history. It was not until the fall of the year that relief was felt. According to the United States Department of Labor, 4,900 persons were employed in gypsum-product plants in February 1946 compared with 4,000 in February 1945, 4,600 in February 1944, and 4,300 in February 1943.

[1] Bureau of Foreign and Domestic Commerce, Department of Commerce, Construction and Construction Materials, April 1946, p. 7.

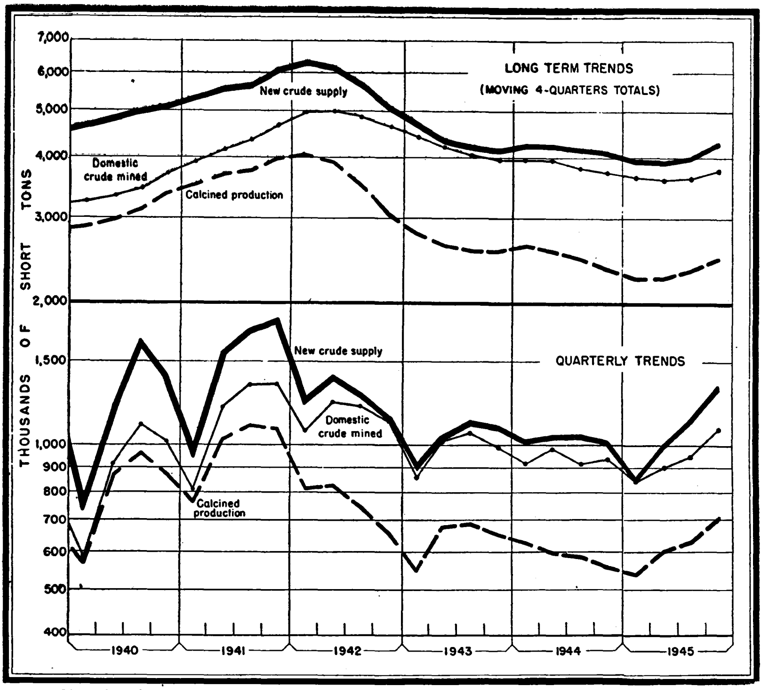

FIGURE 1.—Trends of new crude supply, domestic crude mined, and production of calcined gypsum 1940–45 by quarters.

DOMESTIC PRODUCTION

Increased output of crude gypsum in Texas, Iowa, and Michigan overcame by a small margin decreases in California, Nevada, and New York, resulting in a 1-percent gain in 1945 production over 1944, the wartime low.

Active operations totaled 49, comprising 22 underground mines, 19 open quarries, and 8 mine-quarry combinations.

Crude gypsum mined in the United States, 1943–45, by States

State	1943			1944			1945		
	Active mines	Short tons	Value	Active mines	Short tons	Value	Active mines	Short tons	Value
California	6	455,580	$622,575	6	502,629	$799,882	5	455,319	$967,507
Iowa	6	418,092	595,602	5	398,143	655,392	5	430,843	569,964
Michigan	6	538,602	737,719	4	552,672	891,965	4	640,186	862,028
Nevada	4	347,961	702,906	3	392,748	693,107	3	368,246	732,253
New York	9	713,961	1,229,796	7	594,067	1,128,821	7	557,902	1,262,989
Texas	7	394,841	519,541	7	344,936	489,638	6	407,640	511,869
Other States [1]	18	1,008,504	1,551,476	17	976,039	1,791,962	19	951,587	2,077,714
	56	3,877,541	5,959,615	49	3,761,234	6,450,767	49	3,811,723	6,984,324

[1] By groups of States as follows—1943: Arkansas (1), Kansas (2), and Oklahoma (2)—371,893 tons valued at $501,203; Colorado (3), Montana (2), South Dakota (1), Utah (2), and Wyoming (1)—166,547 tons, $235,628; Ohio (2) and Virginia (2)—470,064 tons, $814,645. 1944: Arkansas (1), Kansas (2), and Oklahoma (2)—295,604 tons, $472,789; Colorado (2), Montana (2), South Dakota (1), Utah (2) and Wyoming (1)—165,360 tons, $296,033; Ohio (2) and Virginia (2)—515,075 tons, $1,023,140. 1945: Arizona (1), Arkansas (1), and Kansas (2)—120,422 tons, $160,156; Colorado (3), Montana (2), South Dakota (1), and Wyoming (1)—129,587 tons, $243,214; Ohio (2) and Virginia (2)—477,595 tons, $1,356,592; Oklahoma (2), and Utah (2)—223,983 tons. $317,752.

CALCINED PRODUCTION AND PROCESSING EQUIPMENT

The calcined production in 1945 was obtained from 44 active plants distributed through 19 States. Active calcining equipment in these plants comprised 176 units. The average mill value of calcined gypsum, which is a "transfer value" assigned by producers, was $5.82 per short ton, a drop of 4 cents from the 1944 value.

Calcined gypsum produced in the United States, 1944–45, by districts [1]

District	1944		1945	
	Short tons	Value	Short tons	Value
New Hampshire, Vermont, Massachusetts, and Connecticut	39,084	$288,714	50,102	$394,764
Eastern New York, New Jersey, Georgia, and Florida	163,820	1,260,031	204,075	1,551,450
Western New York	372,781	2,048,641	394,994	1,951,849
Ohio and Virginia	301,622	1,912,805	309,500	1,961,566
Michigan and Indiana	339,543	1,928,014	374,647	2,222,934
Iowa	279,140	1,427,780	286,422	1,467,605
Kansas and Oklahoma	176,120	1,111,741	178,736	1,164,396
Texas	237,461	1,166,096	273,102	1,288,755
Colorado, Wyoming, South Dakota, Montana, and Utah	98,025	663,738	96,158	707,092
California and Nevada	355,547	2,033,839	317,354	1,763,155
	2,363,143	13,841,399	2,485,090	14,473,566

[1] Made from domestic, imported, and byproduct crude gypsum.

Active calcining plants and equipment in the United States, 1943–45, by States

State	1943			1944			1945		
	Calcining plants	Equipment		Calcining plants	Equipment		Calcining plants	Equipment	
		Kettles	Other calciners [1]		Kettles	Other calciners [1]		Kettles	Other calciners [1]
California	3	7	4	4	7	6	3	7	4
Iowa	5	19		5	17	4	5	15	4
Michigan	5	22		4	20		4	19	
New York	7	22	6	7	22	6	7	20	6
Texas	4	26		4	24		4	27	
Other States [2]	26	73	14	23	61	23	21	54	20
	50	169	24	47	151	39	44	142	34

[1] 1943: Includes rotary and beehive kilns and grinding-calcining units; 1944–45: Includes rotary and beehive kilns, grinding-calcining units, and hydrocal cylinders.
[2] 1943: 1 calcining plant each in Connecticut, Florida, Georgia, Indiana, Massachusetts, New Hampshire, Oklahoma, South Dakota, Vermont, and Wyoming; 2 each in Colorado, Kansas, Montana, Nevada, New Jersey, Ohio, Utah, and Virginia. 1944: 1 calcining plant each in Connecticut, Florida, Indiana, Massachusetts, Oklahoma, South Dakota, and Vermont; 2 each in Colorado, Kansas, Montana, Nevada, New Jersey, Ohio, Utah, and Virginia. 1945: 1 calcining plant each in Connecticut, Georgia, Indiana, Massachusetts, New Jersey, Oklahoma, and South Dakota; 2 each in Colorado, Kansas, Montana, Nevada, Ohio, Utah, and Virginia.

DISTRIBUTION OF SALES, BY USES

Industrial plaster requirements eased even before the war's end, making more plaster available for the Nation-wide construction which began immediately after WPB Limitation Order L–41 was dropped. Sales of uncalcined gypsum were higher than in 1944, as the decrease in shipments of agricultural gypsum was more than compensated by a sharp recovery in portland-cement retarder sales.

Figure 3, correlating sales of lath and other gypsum board with floor area of construction, shows that the gypsum industry failed to get its share of the new construction in 1945. This was due to no lack of demand but to shortages of labor in mines and mills and to lack of shipping facilities from Nova Scotia.

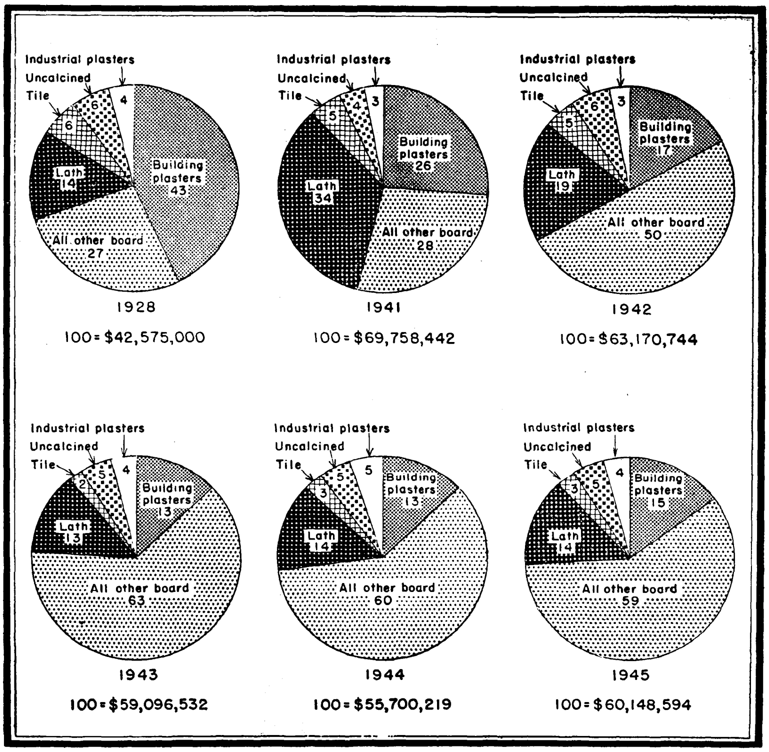

FIGURE 2.—Percentage distribution of total sales value, f. o. b. plant, of gypsum products in 1928 and 1941-45, by groups of products.

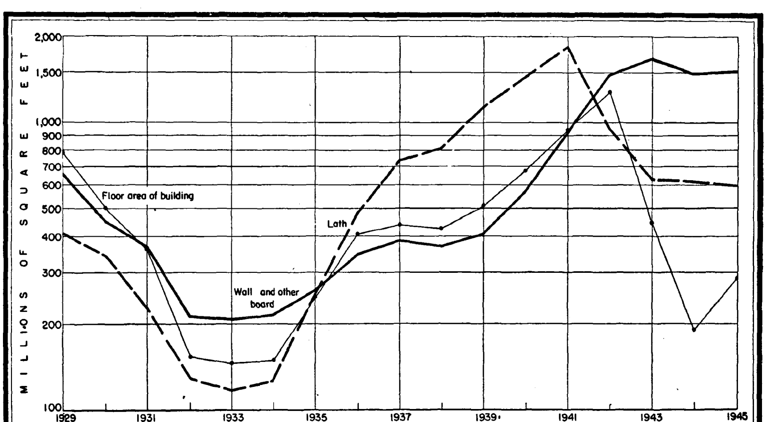

FIGURE 3.—Trends in sales of gypsum lath and wallboard and other board (includes wallboard, laminated board in terms of component board, and sheathing) compared with Dodge Corp. figures on floor area of residential and nonresidential building, 1929-45.

Shipping space from Nova Scotia continued to be restricted during 1945, although less so than in 1944, and Nova Scotia anhydrite available for dusting the peanut crops in Florida, Georgia, and Virginia was in very short supply. Considerable agricultural gypsum was shipped from Plasterco and Saltville, Va., but not enough to meet all demands of peanut growers. Nova Scotia anhydrite commonly analyzes 80 to 85 percent calcium sulfate, but, as it is an anhydrous sulfate its sulfur content is higher than that of gypsum, which contains 21 percent water.

Gypsum products (made from domestic, imported, and byproduct crude gypsum) sold or used in the United States, 1944–45, by uses

Use	1944			1945				
	Short tons	Value		Short tons	Value		Percent of change in—	
		Total	Average		Total	Average	Tonnage	Average value
Uncalcined:								
Portland-cement retarder	565,030	$1,184,061	$2.10	664,247	$1,502,689	$2.26	+18	+8
Agricultural gypsum	477,033	1,613,078	3.38	462,217	1,715,982	3.71	−3	+10
Other uses [1]	14,213	156,425	11.01	21,333	214,056	10.03	+50	−9
Total uncalcined uses	1,056,276	2,953,564		1,147,797	3,432,727		+9	
Industrial:								
Plate-glass and terra-cotta plasters	25,545	171,716	6.72	20,317	136,378	6.71	−20	
Pottery plasters	31,588	420,994	13.33	30,807	414,187	13.44	−2	+1
Orthopedic and dental plasters	12,509	370,776	29.64	13,907	416,712	29.96	+11	+1
Other industrial uses [2]	130,831	1,587,163	[3] 12.13	92,765	1,359,086	14.65	−29	+21
Total industrial uses	200,473	2,550,649		157,796	2,326,363		−21	
Building:								
Cementitious:								
Plasters:								
Base-coat	521,357	4,669,030	8.96	640,276	6,103,402	9.53	+23	+6
Sanded	76,406	456,117	5.97	68,485	428,631	6.26	−10	+5
To mixing plants	19,063	107,653	5.65	10,938	70,827	6.48	−43	+15
Gauging and molding	77,838	910,629	11.70	88,800	1,084,902	12.22	+14	+4
Prepared finishes	5,647	141,863	25.12	6,663	213,211	32.00	+18	+27
Insulating and roof-deck	27,454	218,211	7.95	35,300	286,302	8.11	+29	+2
Other [4]	13,758	643,649	46.78	14,918	681,930	45.71	+8	−2
Keene's cement	12,422	191,588	15.42	14,158	217,723	15.38	+14	
Total cementitious	753,945	7,338,740		879,538	9,086,928		+17	
Prefabricated:								
Lath [5]	470,109	7,908,857	[6] 12.64	445,497	8,177,308	[6] 13.64	[7] −4	[6] +8
Wallboard [8]	974,972	26,507,684	[6] 21.94	1,023,537	28,994,151	[6] 22.53	[7] +7	[6] +3
Sheathing board [9]	117,967	2,300,069	[6] 20.05	102,692	2,304,165	[6] 22.90	[7] −12	[6] +14
Laminated board [10]	179,673	4,714,096	[6] 28.13	125,222	4,002,216	[6] 34.23	[7] −30	[6] +22
Tile [11]	85,308	1,426,560	[12] 41.63	104,943	1,824,736	[12] 42.62	[7] +19	[12] +2
Total prefabricated	1,828,029	42,857,266		1,801,891	45,302,576			
Total building uses		50,196,006			54,389,504			
Grand total value		55,700,219			60,148,594			

[1] Includes uncalcined gypsum sold for use as filler and rock dust, in brewer's fixe, color manufacture, and for unspecified uses.
[2] Includes statuary, industrial casting and molding plasters, dead-burned filler, granite polishing, and miscellaneous uses.
[3] Corrected figure.
[4] Includes joint filler, patching and painter's plaster, and unclassified building plasters.
[5] 1944: 625,553 M square feet; 1945: 599,431 M square feet.
[6] Average value per M square feet.
[7] Percent of change in square footage.
[8] 1944: 1,208,158 M square feet; 1945: 1,286,912 M square feet.
[9] 1944: 114,704 M square feet; 1945: 100,627 M square feet.
[10] Square footage in terms of component board—1944: 167,580 M square feet; 1945: 116,908 M square feet
[11] Includes partition, roof, floor, soffit, shoe, and all other gypsum tiles and planks—1944: 15,067 M square feet; 1945: 17,988 M square feet.
[12] Average value per M square feet of partition tile only.

On the other hand, sales of California agricultural gypsum increased. In the West gypsum is used to neutralize black alkali soils, calcium combining with carbonate ions to form nearly insoluble calcium carbonate, and sulfate combining with sodium to form neutral sodium sulfate.

Gypsum board and tile sold or used in the United States, 1941–45, by types

Year	Lath			Wallboard		
	M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]
1941	1,843,648	$23,524,812	$12.76	757,588	$16,578,698	$21.88
1942	959,307	12,116,144	12.63	1,046,025	23,200,410	22.18
1943	630,639	7,863,506	12.47	1,241,828	27,296,293	21.98
1944	625,553	7,908,857	12.64	1,208,158	26,507,684	21.94
1945	599,431	8,177,308	13.64	1,286,912	28,994,151	22.53

Year	Sheathing			Laminated board [2]			Tile [3]		
	M square feet	Value		M square feet	Value		M square feet	Value	
		Total	Average [1]		Total	Average [1]		Total	Average [4]
1941	175,496	$3,287,699	$18.73	-------	-------	-------	34,877	$3,290,280	$39.53
1942	369,313	7,016,015	19.00	[5] 53,170	$1,464,090	$27.54	24,664	2,915,884	45.81
1943	231,356	4,683,376	20.24	[5] 200,815	5,450,818	27.14	11,639	1,112,654	42.78
1944	114,704	2,300,069	20.05	[5] 167,580	4,714,096	28.13	15,067	1,426,560	41.63
1945	100,627	2,304,165	22.90	[5] 116,908	4,002,216	34.23	17,988	1,824,736	42.62

[1] Per M square feet, f. o. b. producing plant.
[2] New product first marketed in 1942.
[3] Includes partition, roof, floor, soffit, shoe, and all other gypsum tiles and planks.
[4] Per M square feet, f. o. b. producing plant, of partition tile only.
[5] Reported as area of component board and not of finished product.

PRICES

Except for certain modifications discussed hereafter, the prices of gypsum products continued "frozen" in 1945 under Maximum Price Regulation 188 of the Office of Price Administration, based on March 1942 levels. Amendment 70 to Order A–1, February 15, 1945, permitted board mills in Indiana, Iowa, Michigan, Ohio, New York, Massachusetts, Pennsylvania, and Virginia to add actual transportation costs to their f. o. b. plant ceilings for wallboard, lath, sheathing, and laminated gypsum products destined for export from Atlantic ports on Government or Lend-Lease orders. Under Amendment 85 to Order A–1, July 3, 1945, producers of gypsum lath were permitted to add freight costs to lath shipped to Florida, Georgia, Alabama, South Carolina, and part of North Carolina, provided the additional cost should not exceed freight from Plasterco, Va. On August 21 the OPA increased ceiling prices of gypsum lath 3.82 cents and 2.5 cents per square yard, respectively, in the eastern seaboard and the California-Nevada marketing areas, and on September 14 it raised the ceiling price of calcined gypsum "bag goods" in the eastern seaboard area by $2.40 a short ton from a previous ceiling of about $12. The increase could be passed on by resellers, it was stated.

On November 15 a ceiling of $25 per M square feet was placed on water-repellent sheathing, in Order 5 to Maximum Price Regulation 592.

About three-quarters of the gypsum produced in the United States is calcined by the producer and does not enter the open market. The remainder is sold largely as portland-cement retarder and agricultural gypsum. The average value for retarder sales in 1945 was $2.26 per short ton and for agricultural sales $3.71.

The average value reported for crude gypsum mined was $1.83. Most producers presumably report the cost of mining as their value of crude gypsum. Some, however, report the actual value of sales. Some who sell part of their crude and calcine the rest assign the selling price as the value for their entire output, whereas others in this category use mining cost for that calcined and selling price for that sold. For these reasons, the value of gypsum reported for a certain State may represent neither the market value nor the cost of mining but probably an intermediate.

PLANT EXPANSIONS

Increased gypsum facilities are being installed in many parts of the country. The National Gypsum Co. is making a notable addition to East coast capacity by erecting a $2,500,000 board and plaster plant in Baltimore with rated capacity 25 percent greater than its Bronx plant. The installation will have six kettles. The Baltimore Port Development Commission is building pier and rock storage facilities for the plant, which will use gypsum imported from its mines at Walton, Dingwall, and Cheticamp, Nova Scotia. The firm's Savannah, Ga., board plant is being expanded 25 percent at a cost of $350,000, and the Portsmouth, N. H., board plant, shut down in 1944 owing to inability to import gypsum, is being reopened. Improvements are being made in the Niles, Ohio, metal lath plant; a new quarry is being opened at Fort Dodge, Iowa; and $300,000 is being spent on the Rotan, Tex., plant. Two ships were purchased to import Nova Scotia gypsum, and a third was to be acquired in May 1946. The company expects to increase its over-all capacity by 25 percent, it is said.

On the West coast the Kaiser interests are readying the wallboard plant at Long Beach, Calif., leased from Standard Gypsum Co. in 1944, and it is reported that the plant will offer agricultural gypsum, wallboard, and lath by the middle of 1946. The firm has completed negotiations with the Mexican Government for access to an estimated half-billion-ton deposit of gypsum on San Marcus Island on the Gulf of Lower California. The plant was formerly leased and operated by Pacific Portland Cement Co. The latter firm is reported to have sold its Plaster City, Calif., plant to the United States Gypsum Co.

The Blue Diamond Corp., Los Angeles, Calif., is augmenting its open-pit production at Blue Diamond, Nev., by adding underground operations. The firm has ordered new grinding equipment and contemplates enlarging its entire gypsum operation. Sulfur Springs Gypsum Co. has opened a new mine at Thermopolis, Wyo., for gypsum fertilizer. Monterey Gypsum Co. has reopened a deposit near King

City, Calif., which has been worked intermittently since 1898. The plant, which is producing agricultural gypsum, has a capacity of 200 tons per 8 hours. The Arizona Gypsum Co., Phoenix, Ariz., has begun the production of agricultural gypsum.

The Texas Cement Plaster Co. sold its assets, including its open-pit gypsum quarry at Longworth, Tex., and its plaster and board plant at Hamlin, Tex., to the Celotex Corp. of Chicago.

RECENT TECHNICAL DEVELOPMENTS

Resin-impregnated plasters [2] were introduced in 1945.

They offer increased temperature and moisture resistance to contour blocks, check patterns, and mock-ups in foundry and machine shop. The form is rendered tougher if glass wool is added to the plaster mix before it is poured. Resin is added in two ways, either as a slurry mixed with the plaster or as a slurry applied to the set, dried plaster. In the latter application the resin is taken up by capillary action.

Mechanization of gypsum mines received further impetus during the war, owing to the labor shortage. The use of caterpillar-mounted loading machines with battery-operated, rubber-tired shuttle cars in mines of the Certainteed Products Corp. has been described.[3]

RECONVERSION PROBLEMS

As gypsum was an essential war commodity in virtually all of its uses, reconversion to peacetime production in general involves making greater quantities of the same products that were made during the war. Many of the larger producers complain of labor shortages and therefore they welcome the return of war veterans. The manpower lack is perhaps felt more keenly in the mines than in the plants, for underground work is generally less appealing to the inexperienced applicant. The smaller producers appear to be better off as regards manpower than the larger organizations. A potent factor in board production is the shortage of paper liner, which is expected to ease somewhat during 1946.

FOREIGN TRADE [4]

Of the 502,530 short tons of gypsum and anhydrite imported from Canada, 309,980 tons was landed in the New York customs district, 66,507 in the Georgia district, 56,776 in the Massachusetts district, and 32,564 in the Virginia district. The imports from Newfoundland were landed in the Virginia district, and the receipts reported from the Dominican Republic were shipped to Puerto Rico for consumption there.

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[2] Iron Age, vol. 156, No. 21, Nov. 22, 1945, p. 72.
Chemical Industries, vol. 57, No. 7, December 1945, p. 1088.
Chemical and Metallurgical Engineering, vol. 52, No. 9, October 1945, p. 258.

[3] Cushing, E. R., Gypsum Property Modernizes with Trackless Mining: Eng. and Min. Jour., vol. 146, No. 6, June 1945, pp. 78–81.

[4] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Gypsum and gypsum products imported for consumption in the United States, 1941–45

Year	Crude (including anhydrite)		Ground		Calcined		Keene's cement		Alabaster manufactures [1]	Other manufactures, n. e. s.	Total value
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value			
1941	1,347,957	$1,225,152	1,631	$30,499	242	$6,416	34	$945	$3,232	$15,896	$1,282,140
1942	394,460	478,144	1,048	20,427	309	8,205	20	484	227	834	508,321
1943	231,323	275,503	958	18,902	73	1,950	16	392	1,064	6,343	304,154
1944	342,462	382,533	376	6,965	75	2,653	4	120	318	2,014	394,603
1945	508,762	525,066	231	4,545	67	2,209			499	16,378	548,697

[1] Includes imports of jet manufactures, which are reported to be negligible.

Crude gypsum (including anhydrite) imported for consumption in the United States, 1943–45, by countries

Country	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada	230,429	$271,755	339,956	$372,468	502,530	$507,212
Dominican Republic	894	3,748	2,504	10,045	3,652	15,274
India and Dependencies			2	20		
Newfoundland and Labrador					2,580	2,580
	231,323	275,503	342,462	382,533	508,762	525,066

Wallboard exports again increased in 1945, owing largely to price increases allowed to board mills in the Ohio area, conditioned on export.

Gypsum and gypsum products exported from the United States, 1941–45

Year	Crude, crushed, or ground		Plasterboard and wallboard		Calcined		Other manufactures, n. e. s.	Total value
	Short tons	Value	Square feet	Value	Short tons	Value		
1941	15,491	$72,877	13,560,482	$296,848	3,041	$90,397	$69,452	$529,574
1942	595	14,543	39,489,186	772,989	1,859	84,784	105,547	977,863
1943	5,300	22,405	2,953,173	84,163	2,436	98,229	78,923	283,720
1944	870	18,604	7,236,665	180,021	5,620	166,145	125,210	489,980
1945	1,067	18,909	31,835,980	1,017,677	8,961	248,853	217,229	1,502,668

WORLD PRODUCTION

As shown in the accompanying table, gypsum is mined in many countries. Owing to the late war, output has been generally curtailed the world over and recent figures are lacking for many of the principal producers. World production probably attained nearly 10,000,000 metric tons in 1937 but has been nowhere near that figure in recent years. Among the leading foreign producers in normal times are

France, Germany, Great Britain, Spain, and the Soviet Union. The famous Paris Basin of France is well known for its Tertiary gypsum deposits, many 60 feet thick. German deposits in the Harz Mountains, Thuringia, Saxony, and other areas, were mined not only for building purposes but as a raw material for sulfuric acid and other sulfur chemicals of commerce. Such German data as are available are incomplete, as captive tonnage mined and consumed by cement plants is not counted in the totals. In 1935 (latest available) a production of 855,000 metric tons was reported. Russian figures have not been available since 1934, when output was announced as 688,000 metric tons. Before the Spanish Civil War about 700,000 metric tons were mined in Spain annually; the latest available figures (see table) show about one-tenth that amount, or less.

World production of gypsum, 1938–45 by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Algeria	33,325	(2)	(2)	23,375	23,720	17,920	(2)	(2)
Anglo-Egyptian Sudan	---------	---------	---------	748	1,558	3,641	(2)	(2)
Argentina [3]	70,813	97,328	103,157	133,848	127,188	122,427	(2)	(2)
Australia:								
New South Wales	12,712	7,145	11,010	23,458	19,564	36,862	20,540	(2)
South Australia	148,943	147,266	155,901	115,323	58,124	40,157	(2)	(2)
Victoria	13,596	11,966	7,237	16,013	9,130	8,605	8,717	(2)
Western Australia	13,645	14,570	13,229	9,666	2,924	950	3,662	(2)
Belgian Congo	1,000	(2)	500	2,533	2,937	(2)	(2)	(2)
Brazil	[4] 2,000	(2)	[5] 45,000	(2)	(2)	(2)	(2)	(2)
Canada	983,435	1,390,183	1,397,778	1,415,600	723,137	390,833	486,571	[6] 746,047
Chile	24,551	22,209	25,865	23,125	28,028	32,893	33,909	(2)
China	(2)	(2)	75,000	(2)	(2)	(2)	(2)	(2)
Cuba	7,257	6,270	12,000	12,000	4,303	2,921	9,008	(2)
Cyprus (exports)	9,729	5,052	1,423	152	228	112	(2)	(2)
Dominican Republic (exports)	---------	---------	---------	3,040	(2)	916	2,146	3,258
Egypt	212,088	700,166	169,723	130,942	118,931	91,881	106,299	(2)
Eire	13,364	16,168	21,662	24,660	16,567	21,453	21,394	(2)
Estonia	13,915	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Greece	16,609	15,219	(2)	(2)	(2)	(2)	(2)	(2)
India, British	70,944	69,786	79,257	53,910	64,386	83,587	(2)	(2)
Iraq	---------	69,545	34,879	(2)	(2)	(2)	(2)	(2)
Italy	425,299	433,145	454,662	328,445	(2)	(2)	(2)	(2)
Kenya	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Latvia	220,000	245,035	(2)	(2)	(2)	(2)	(2)	(2)
Luxembourg	19,901	(2)	(2)	(2)	(2)	(2)	(2)	(2)
New Caledonia	1,070	(2)	3,000	(2)	(2)	(2)	16,692	(2)
Palestine	3,984	4,524	4,403	4,841	8,118	5,990	7,428	(2)
Peru	14,026	15,655	21,478	22,472	19,514	20,326	25,190	[4] 27,000
Portugal	9,036	(2)	(2)	(2)	(2)	4,367	(2)	(2)
Rumania	69,079	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain	(2)	(2)	(2)	(2)	37,567	73,291	59,889	(2)
Sweden	95	102	13	(2)	(2)	(2)	(2)	(2)
Switzerland	35,000	38,000	30,000	35,000	38,000	42,000	46,000	97,000
Syria	(2)	(2)	(2)	1,000	5,000	2,500	(2)	(2)
Union of South Africa	38,849	40,782	46,202	(2)	(2)	(2)	[6] 57,426	(2)
United Kingdom	1,109,928	1,042,760	1,032,275	1,196,900	1,231,613	1,389,914	1,344,485	(2)
United States	2,435,057	2,927,231	3,355,672	4,344,062	4,261,540	3,517,628	3,412,116	3,457,919

[1] In addition to the countries listed gypsum is produced in Austria, France, French Morocco, Germany, Japan, Korea (Chosen), Mexico, Poland, Tunisia, U. S. S. R., and Yugoslavia, but production data are not available.
[2] Data not available.
[3] Rail and river shipments.
[4] Approximate production.
[5] Production of one company only.
[6] Sales.

CANADA

Preliminary figures of the Dominion Bureau of Statistics show sales of 822,380 short tons of gypsum for 1945 compared with 596,164 tons for 1944. The Canadian gypsum industry is reviving. New deposits are being opened and new calcining and other equipment installed. Gypsum, Lime & Alabastine, Ltd., Toronto, placed in operation a new plaster, wallboard, and lath plant at New Westminister, B. C. A permit has been granted to Western Gypsum Products, Ltd., for the construction of a gypsum plant in Alberta costing $250,000. The crude rock will be hauled by rail from the Crows Nest Pass in southwestern Alberta. The same firm is constructing a board plant at Calgary, Alberta, which when completed will employ 50 people. Gypsum mined at Maynook, B. C., will be used.[5] Plans were drawn up to replace the buildings of Canadian Gypsum Co., Ltd., destroyed by fire at Weston, Ont., in February 1945, the program calling for an expenditure of $400,000.[6]

[5] Foreign Commerce Weekly, Vol. 20, No. 9, Aug. 25, p. 29. See also Canada Department of Trade and Commerce, Dominion Bureau of Statistics, Gypsum Industry in Canada: Ottawa, 1944, pp. 1–2.
[6] Pit and Quarry, vol. 38, No. 8, February 1946, p. 60.

LIME

By Oliver Bowles and F. D. Gradijan

SUMMARY OUTLINE

SUMMARY

The lime industry experienced a moderate decline in 1945. Sales of "open-market" lime totaled 5,920,579 short tons—a decline of 9 percent from 1944 and 10 percent from the all-time high of 1943. The average price per ton increased 24 cents. Quicklime represented 77 percent and hydrated lime 23 percent of the total, whereas in 1944 the percentages were 80 and 20, respectively. Sales of agricultural lime declined 20 percent. The upward trend in the construction industries was reflected in a 6-percent gain in sales of building lime. The decline in production of war materials without a corresponding gain in peacetime manufacturing industries led to a 9-percent drop in sales of chemical and industrial lime and an 8-percent drop in sales of dead-burned dolomite.

The supply situation with respect to chemical and industrial lime continued to be somewhat critical throughout the year. Threatened shortages were due primarily to unavailability of labor.

The permitted maximum prices of building and chemical lime were, except for certain amendments and individual adjustments, continued through 1945 at the March 1942 level as fixed by Maximum Price Regulation 188. Even though Regulation 188 was superseded by Maximum Price Regulation 592 on August 1, 1945, the price freeze, as of March 1942, was not altered. Amendments permitted an upward revision of prices as follows: Effective April 13, 1945, an increase of 45 cents a ton for lime produced in Clark, Delaware, Franklin, and Preble Counties, Ohio; effective May 12, 1945, an increase of 65 cents a ton for lime produced in Virginia, North Carolina, South Carolina, Georgia, Alabama, Tennessee, Mississippi, and Louisiana; effective June 21, 1945, an increase of 75 cents a ton for

Salient statistics of the lime industry in the United States, 1925–29 (average), 1935–39 (average), and 1943–45

	1925–29 (average)	1935–39 (average)	1943	1944	1945
Active plants	419	310	245	210	189
Sold by producers:					
By types:					
Quicklime ... short tons	2,871,236	2,488,269	5,283,227	5,150,545	4,565,551
Hydrated ... do	1,585,631	1,204,128	1,313,388	1,323,018	1,355,028
Total lime:					
Short tons	4,456,867	3,692,397	6,596,615	6,473,563	5,920,579
Value [1]	$38,548,498	$26,592,115	$49,064,328	$48,698,162	$45,918,468
Per ton	$8.65	$7.20	$7.44	$7.52	$7.76
By uses:					
Agricultural ... short tons	318,224	350,535	454,133	466,390	373,410
Building ... do	2,096,744	870,335	557,958	520,000	549,547
Chemical and industrial ... do	1,623,885	1,929,947	4,307,799	4,196,383	3,810,288
Refractory (dead-burned dolomite) short tons	418,014	541,580	1,276,725	1,290,790	1,187,334
Imported for consumption:					
Short tons	18,683	14,108	15,390	17,788	20,858
Value	$344,887	$240,909	$148,591	$151,420	$179,210
Exported:					
Short tons	15,752	10,905	23,284	22,689	24,276
Value	$221,177	$123,167	$255,135	$216,642	$268,875

[1] Selling value, f. o. b. plant, excluding cost of containers.

lime produced in Arkansas, Kansas, Nebraska, Oklahoma, and that part of Missouri west of the 93d meridian; and effective August 13, 1945, an increase of $1.20 a ton for lime produced in Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, and that part of New York east of the 77th meridian. In addition to these regional authorizations, many individual price adjustments were granted to lime producers in States not covered by the regional amendments.

The regional authorizations did not affect prices of agricultural lime, which were controlled by Maximum Price Regulation 386. However, numerous individual price adjustments were granted producers of agricultural lime.

PRODUCTION

Production in 1945 increased for building uses but declined in all other categories. As stocks of lime are small, the sales given in the following table are regarded as equivalent to production of "open-market" lime.

Lime sold by producers in the United States, 1944–45, by types and major uses

	1944				1945				Percent of change in—	
	Quantity		Value [1]		Quantity		Value [1]			
	Short tons	Percent of total	Total	Average	Short tons	Percent of total	Total	Average	Tonnage	Average value
By types:										
Quicklime	5,150,545	80	$38,055,518	$7.39	4,565,551	77	$34,496,214	$7.56	−11	+2
Hydrated lime	1,323,018	20	10,642,644	8.04	1,355,028	23	11,422,254	8.43	+2	+5
Total lime [2]	6,473,563	100	48,698,162	7.52	5,920,579	100	45,918,468	7.76	−9	+3
By uses:										
Agricultural:										
Quicklime	168,364	2	1,085,217	6.45	120,529	2	827,920	6.87	−28	+7
Hydrated lime	298,026	5	2,391,658	8.02	252,881	4	2,078,924	8.22	−15	+2
	466,390	7	3,476,875	7.45	373,410	6	2,906,844	7.78	−20	+4
Building:										
Quicklime	126,944	2	1,225,216	9.65	115,521	2	1,147,021	9.93	−9	+3
Hydrated lime	393,056	6	3,261,816	8.30	434,026	8	3,762,343	8.67	+10	+4
	520,000	8	4,487,032	8.63	549,547	10	4,909,364	8.93	+6	+3
Chemical and industrial:										
Quicklime	3,564,447	55	24,303,473	6.82	3,142,167	53	21,907,562	6.97	−12	+2
Hydrated lime	631,936	10	4,989,170	7.90	668,121	11	5,580,987	8.35	+6	+6
	4,196,383	65	29,292,643	6.98	3,810,288	64	27,488,549	7.21	−9	+3
Refractory (dead-burned dolomite)	1,290,790	20	11,441,612	8.86	1,187,334	20	10,613,711	8.94	−8	+1

[1] Selling value, f. o. b. plant, excluding cost of containers.
[2] Includes lime used by producers (captive tonnage) as follows—1944: 432,166 tons, valued at $2,570,544; 1945: 368,572 tons, $2,216,373.

CAPTIVE TONNAGE

The reader is referred to the chapter on Lime of Minerals Yearbook, 1944, for a somewhat detailed discussion of the interpretation of captive tonnage as applied to the lime industry by the Bureau of Mines. It is evident that the statistics of greatest interest and value to the lime industry and to others who may be following economic trends are those of the "open-market" lime that freely enters trade. Accordingly, the captive tonnage lime—that is, the lime used in the plant where it is made—is excluded from the statistical tables of this chapter. The only exception is the inclusion of a moderate tonnage of captive lime applied to special uses for which complete coverage was obtained from the lime reports.

The captive tonnage reported to the Bureau as limestone is included in the statistics on limestone in the chapter on Stone of this volume. If reported as lime, it is generally converted to its equivalent of limestone and also included in the statistics of stone.

PRODUCTION BY STATES

In 1945 lime was produced at 189 plants in 36 States and 2 Territories. Production by States and Territories insofar as figures may be segregated, is indicated in the following table.

Lime sold by producers in the United States, 1944–45, by States

State or Territory	1944			1945		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	7	333, 414	$2, 004, 391	7	315, 559	$2, 076, 768
Arizona	3	61, 091	527, 792	3	58, 736	522, 609
Arkansas	2	(1)	(1)	1	(1)	(1)
California	9	130, 763	1, 441, 604	9	135, 158	1, 515, 497
Colorado	2	(1)	(1)	2	(1)	(1)
Connecticut	1	(1)	(1)	1	(1)	(1)
Florida	4	17, 959	185, 565	3	18, 431	211, 077
Georgia	1	6, 079	45, 315	1	3, 864	32, 797
Hawaii	1	8, 726	140, 776	1	8, 114	130, 085
Illinois	7	290, 988	2, 266, 539	7	287, 607	2, 229, 335
Indiana	2	(1)	(1)	1	(1)	(1)
Louisiana	1	(1)	(1)	1	(1)	(1)
Maine	2	(1)	(1)	2	(1)	(1)
Maryland	9	69, 514	534, 743	7	66, 675	502, 376
Massachusetts	3	87, 295	745, 573	3	94, 499	816, 733
Michigan	3	119, 446	869, 337	3	(1)	(1)
Minnesota	1	(1)	(1)	1	(1)	(1)
Missouri	11	908, 340	5, 820, 028	10	753, 932	5, 031, 222
Montana	2	(1)	(1)	2	(1)	(1)
Nevada	2	(1)	(1)	2	(1)	(1)
New Jersey	3	(1)	(1)	3	(1)	(1)
New Mexico	1	(1)	(1)	1	(1)	(1)
New York	4	193, 395	1, 410, 956	3	(1)	(1)
North Carolina	1	(1)	(1)	1	(1)	(1)
Ohio	20	1, 467, 575	11, 876, 409	18	1, 420, 983	11, 693, 615
Oklahoma	1	(1)	(1)	1	(1)	(1)
Oregon	1	(1)	(1)	1	(1)	(1)
Pennsylvania	35	1, 026, 292	7, 933, 361	31	903, 914	7, 221, 808
Puerto Rico	5	5, 692	121, 702	5	7, 504	173, 643
South Dakota	1	(1)	(1)	2	(1)	(1)
Tennessee	9	193, 202	1, 246, 802	8	207, 587	1, 373, 268
Texas	8	94, 923	757, 141	7	105, 277	807, 332
Utah	4	51, 202	379, 550	5	47, 484	353, 671
Vermont	4	45, 624	294, 902	4	38, 096	267, 478
Virginia	20	154, 160	1, 129, 342	15	118, 707	835, 575
Washington	4	55, 241	667, 546	2	(1)	(1)
West Virginia	7	493, 724	3, 464, 019	6	511, 509	3, 620, 401
Wisconsin	9	138, 750	1, 030, 322	9	124, 560	988, 422
Undistributed [2]		520, 168	3, 804, 447		692, 383	5, 514, 756
	210	6, 473, 563	48, 698, 162	189	5, 920, 579	45, 918, 468

[1] Included under "Undistributed."
[2] Includes items entered as "(1)."

Lime sold by producers in the United States in 1945, by States and uses

State or Territory	Agricultural		Building		Chemical and industrial: Metallurgical		Chemical and industrial: Paper mills		Chemical and industrial: Tanneries		Chemical and industrial: Water purification		Chemical and industrial: Other		Refractory		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama	581	$4,563	33,384	$263,262	153,757	$892,906	83,878	$545,959	(1)	(1)	10,692	$103,763	(1)	(1)	(1)	(1)	315,559	$2,076,768
Arizona	----	----	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	(1)	(1)	----	----	58,736	522,609
Arkansas	----	----	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
California	1,186	13,266	37,610	467,183	19,566	156,175	5,166	57,637	795	$9,948	9,220	92,360	(1)	(1)	(1)	(1)	135,158	1,515,497
Colorado	----	----	700	7,091	(1)	(1)	----	----	----	----	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut	(1)	(1)	(1)	(1)	----	----	(1)	(1)	----	----	----	----	----	----	----	----	(1)	(1)
Florida	----	----	(1)	(1)	----	----	----	----	----	----	9,885	117,012	(1)	(1)	----	----	18,431	211,077
Georgia	324	4,762	3,540	28,035	----	----	----	----	----	----	----	----	----	----	----	----	3,864	32,797
Hawaii	----	----	1,038	16,869	----	----	----	----	----	----	----	----	7,076	$113,216	----	----	8,114	130,085
Illinois	(1)	(1)	7,184	80,571	116,901	790,678	(1)	(1)	(1)	(1)	33,050	240,994	(1)	(1)	(1)	(1)	287,607	2,229,335
Indiana	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Louisiana	----	----	(1)	(1)	----	----	----	----	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Maine	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Maryland	(1)	(1)	(1)	(1)	----	----	----	----	----	----	----	----	(1)	(1)	----	----	66,675	502,376
Massachusetts	7,534	46,353	23,024	205,376	(1)	(1)	10,790	98,250	(1)	(1)	(1)	(1)	34,398	311,567	----	----	94,499	816,733
Michigan	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Minnesota	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Missouri	----	----	24,285	189,239	120,391	744,469	(1)	(1)	(1)	(1)	97,990	659,621	395,030	2,542,403	(1)	(1)	753,932	5,031,222
Montana	----	----	(1)	(1)	(1)	(1)	----	----	----	----	----	----	(1)	(1)	----	----	(1)	(1)
Nevada	----	----	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
New Jersey	(1)	(1)	(1)	(1)	----	----	----	----	----	----	----	----	(1)	(1)	----	----	(1)	(1)
New Mexico	----	----	(1)	(1)	----	----	----	----	----	----	(1)	(1)	----	----	----	----	(1)	(1)
New York	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)
North Carolina	----	----	(1)	(1)	----	----	----	----	----	----	----	----	----	----	----	----	(1)	(1)
Ohio	63,701	467,754	249,479	2,016,172	93,995	585,655	31,713	201,762	----	----	(1)	(1)	(1)	(1)	706,448	$6,396,891	1,420,983	11,693,615
Oklahoma	----	----	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
Oregon	----	----	(1)	(1)	----	----	----	----	----	----	----	----	----	----	----	----	(1)	(1)
Pennsylvania	151,700	1,310,954	24,304	239,056	247,978	1,804,803	69,431	512,703	34,080	252,316	53,993	429,964	(1)	(1)	(1)	(1)	903,914	7,221,808
Puerto Rico	----	----	5,621	139,494	----	----	----	----	(1)	(1)	(1)	(1)	1,824	32,799	----	----	7,504	173,643
South Dakota	----	----	(1)	(1)	(1)	(1)	----	----	----	----	(1)	(1)	----	----	----	----	(1)	(1)
Tennessee	1,412	11,286	16,847	131,166	36,929	228,632	54,478	350,817	3,525	25,595	20,126	137,583	74,270	488,189	----	----	207,587	1,373,268
Texas	----	----	32,364	279,001	10,291	69,490	14,922	93,849	----	----	30,270	224,046	17,430	140,946	----	----	105,277	807,332
Utah	----	----	2,485	36,565	39,843	258,100	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	47,484	353,671
Vermont	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	38,096	267,478
Virginia	21,995	173,265	8,867	74,872	20,515	103,801	9,188	65,591	(1)	(1)	10,205	79,323	(1)	(1)	----	----	118,707	835,575
Washington	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	----	----	(1)	(1)	(1)	(1)	----	----	(1)	(1)
West Virginia	18,704	113,924	(1)	(1)	290,728	1,945,216	(1)	(1)	(1)	(1)	11,311	76,180	(1)	(1)	(1)	(1)	511,509	3,620,401
Wisconsin	3,968	24,964	14,343	132.821	(1)	(1)	25,523	208,692	(1)	(1)	(1)	(1)	53,831	429,897	----	----	124,560	988,422
Undistributed [2]	102,305	735,753	64,472	602,591	291,808	2,175,199	205,743	1,605,434	42,813	325,634	115,416	873,964	789,524	6,285,411	480,886	4,216,820	692,383	5,514,756
	373,410	2,906,844	549,547	4,909,364	1,442,702	9,755,124	510,832	3,740,694	81,213	613,493	402,158	3,034,810	1,373,383	10,344,428	1,187,334	10,613,711	5,920,579	45,918,468

[1] Included under "Undistributed."

[2] Includes items entered as "(1)."

Lime sold by producers in the United States, 1944–45, by uses

Use	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	466,390	$3,476,875	$7.45	373,410	$2,906,844	$7.78
Building:						
Finishing lime	210,188	1,847,655	8.79	229,034	2,131,458	9.31
Mason's lime	224,544	1,924,728	8.57	241,802	2,111,177	8.73
Prepared masonry mortars	27,828	200,527	7.21	27,693	193,274	6.98
Unspecified	57,440	514,122	8.95	51,018	473,455	9.28
	520,000	4,487,032	8.63	549,547	4,909,364	8.93
Chemical and industrial:						
Alkalies (ammonium, potassium, and sodium compounds)	3,903	29,796	7.63	(1)	(1)	(1)
Asphalts and other bitumens	720	4,470	6.21			
Bleach, liquid and powder [2]	11,971	90,036	7.52	24,712	192,041	7.77
Brick, sand-lime and slag	3,118	27,967	8.97	12,641	108,974	8.62
Brick, silica (refractory)	15,929	128,574	8.07	15,332	139,105	9.07
Calcium carbide and cyanamide	476,810	3,256,788	6.83	364,944	2,534,625	6.95
Chromates and bichromates	34,676	227,646	6.56	36,252	239,812	6.62
Coke and gas (gas purification and plant byproducts)	27,389	189,189	6.91	31,173	221,576	7.11
Explosives	21,215	163,827	7.72	15,531	124,933	8.04
Food products:						
Creameries and dairies	6,608	65,344	9.89	7,298	69,792	9.56
Gelatin	6,834	52,865	7.74	5,027	38,091	7.58
Stock feed	5,720	50,022	8.75	10,798	109,718	10.16
Other [3]	5,924	58,014	9.79	4,584	43,774	9.55
Glassworks	210,802	1,553,211	7.37	220,853	1,631,019	7.39
Glue	9,131	67,557	7.40	9,148	70,114	7.66
Grease, lubricating	1,294	10,986	8.49	2,068	15,282	7.39
Insecticides, fungicides, and disinfectants	79,378	632,573	7.97	82,507	713,465	8.65
Magnesia (85 percent)	27,526	280,676	10.20	23,647	210,544	8.90
Medicines and drugs	6,707	43,156	6.43	7,897	53,560	6.78
Metallurgy:						
Nonferrous smelter flux	7,436	55,551	7.47	7,442	59,695	8.02
Steel (open-hearth and electric furnace flux)	1,173,657	7,817,450	6.66	1,064,005	7,136,870	6.71
Ore concentration [4]	496,001	3,221,744	6.50	342,742	2,316,172	6.76
Wire drawing	15,807	150,700	9.53	16,645	147,508	8.86
Other [5]	35,036	249,403	7.12	11,868	94,879	7.99
Paints	10,398	85,339	8.21	18,950	136,215	7.19
Paper mills [6]	532,391	3,742,157	7.03	510,832	3,740,694	7.32
Petroleum refining	34,126	297,859	8.73	53,176	448,091	8.43
Rubber manufacture	5,634	44,571	7.91	7,170	51,133	7.13
Salt refining	5,498	39,479	7.18	1,884	13,103	6.95
Sewage and trade-wastes treatment	64,189	478,498	7.45	71,496	561,649	7.86
Soap and fat	6,036	37,085	6.14	5,221	33,246	6.37
Sugar refining	22,789	257,024	11.28	24,584	279,843	11.38
Tanneries	82,723	612,750	7.41	81,213	613,493	7.55
Varnish	806	7,496	9.30	364	3,460	9.51
Water purification	374,788	2,765,975	7.38	402,158	3,034,310	7.55
Wood distillation	743	5,910	7.95	1,265	11,624	9.19
Undistributed [7]	23,242	191,104	8.22	25,032	235,843	9.42
Unspecified	349,428	2,299,851	6.58	289,829	2,053,796	7.09
	4,196,383	29,292,643	6.98	3,810,288	27,488,549	7.21
Refractory lime (dead-burned dolomite)	1,290,790	11,441,612	8.86	1,187,334	10,613,711	8.94
Total lime [8]	6,473,563	48,698,162	7.52	5,920,579	45,918,468	7.76
Hydrated lime included in above distribution	1,323,018	10,642,644	8.04	1,355,028	11,422,254	8.43

[1] Included under "Undistributed."
[2] Excludes bleach used in paper mills.
[3] Includes chocolate, cocoa, fruit juices, phosphate baking powders, and unspecified food products.
[4] Includes flotation, cyanidation, bauxite purification, and magnesium manufacture.
[5] Includes mold coating and unspecified.
[6] Includes bleach used in paper mills.
[7] Includes acid neutralization, alcohol, calcium carbonate (precipitated), cement manufacture, polishing compounds, retarder, sulfur, textiles, tobacco, and wool pullers.
[8] Includes lime used by producers (captive tonnage) as follows—1944: 432,166 tons, valued at $2,570,544; 1945: 368,572 tons, $2,216,373.

PRODUCTION BY USES

The use pattern of lime changes from year to year, according to circumstances. Direct and indirect war uses have characterized recent years, and war was the principal controlling influence during most of 1945. A drift to peacetime uses was under way during the last quarter of the year, but reconversion had made too little progress by the end of the year to have any marked effect on the lime industry.

Lime and other liming materials used in agriculture.—The total effective lime content of all agricultural liming materials sold in 1945 decreased 9 percent from 1944.

Building lime.—As building construction of types that use mortar or plaster was at a low level throughout 1945 sales of building lime were correspondingly low, but a 6-percent gain in sales of building lime indicate an upward trend.

Agricultural lime and other liming materials sold by producers in the United States, 1944–45, by kinds

Kind	1944				1945			
	Short tons		Value		Short tons		Value	
	Gross	Effective lime content[1]	Total	Average	Gross	Effective lime content[1]	Total	Average
Lime:								
Quicklime	168, 364	143, 110	$1, 085, 217	$6. 45	120, 529	102, 450	$827, 920	$6. 87
Hydrated lime	298, 026	208, 620	2, 391, 658	8. 02	252, 881	177, 020	2, 078, 924	8. 22
Oystershells (crushed)[2]	109, 989	51, 690	329, 708	3. 00	[3] 125, 682	[3] 59, 070	[3] 469, 881	[3] 3. 74
Limestone	18, 941, 220	8, 902, 370	25, 316, 219	1. 34	17, 395, 570	8, 175, 920	25, 892, 317	1. 49
Calcareous marl	178, 036	74, 780	171, 599	. 96	154, 122	64, 730	188, 311	1. 22
	----------	9, 380, 570	29, 294, 401	--------	----------	8, 579, 190	29, 457, 353	--------

[1] Effective lime contents as follows: Quicklime, 85 percent; hydrated lime, 70 percent; limestone and oystershells, 47 percent; calcareous marl, 42 percent.
[2] Figures supplied by Fish and Wildlife Service.
[3] Preliminary figure.

Chemical and industrial lime.—Although there was a general overall decline of 9 percent in the quantity of lime sold for chemical and industrial uses, the quantities used in several industries increased. Large increases were recorded for water purification, petroleum refining, bleach, sand-lime and slag brick, and paints. The large decline in sales for calcium carbide and cyanamide manufacture was to be expected because of a diminishing need for acetylene gas in welding and in the manufacture of synthetic rubber. The quantities of lime sold for ore concentration and explosives also declined greatly. Further details are indicated in the accompanying table.

HYDRATED LIME

Production of hydrated lime, which gained 2 percent in 1945, represented 23 percent of the total output compared with 20 percent in both 1943 and 1944. Active hydrating plants numbered 125 and were distributed in 34 States and 2 Territories. The following table shows production by States.

Hydrated lime sold by producers in the United States, 1944–45, by States

State or Territory	1944			1945		
	Active plants	Short tons	Value	Active plants	Short tons	Value
Alabama	5	35, 528	$283, 558	5	38, 230	$363, 676
California	7	32, 008	381, 378	7	38, 748	485, 482
Florida	3	10, 245	106, 978	(1)	(1)	(1)
Georgia	1	6, 079	45, 315	1	3, 540	28, 035
Hawaii	1	8, 686	138, 976	1	8, 105	129, 680
Illinois	5	37, 001	282, 527	5	34, 780	268, 729
Maryland	5	30, 652	226, 751	5	34, 653	259, 508
Massachusetts	3	47, 732	389, 906	(1)	(1)	(1)
Missouri	9	196, 196	1, 364, 397	8	190, 861	1, 439, 524
New York	3	14, 390	109, 166	(1)	(1)	(1)
Ohio	16	326, 366	2, 421, 907	14	359, 078	2, 832, 982
Pennsylvania	15	251, 156	2, 118, 008	12	250, 972	2, 189, 738
Puerto Rico	3	3, 827	88, 856	(1)	(1)	(1)
Tennessee	7	43, 790	343, 491	6	47, 889	388, 361
Texas	5	35, 075	332, 657	5	38, 896	355, 735
Virginia	13	48, 200	392, 803	10	41, 247	336, 070
West Virginia	5	43, 496	275, 440	4	39, 635	260, 554
Other States [2]	34	152, 591	1, 340, 530	42	228, 394	2, 084, 180
	140	1, 323, 018	10, 642, 644	125	1, 355, 028	11, 422, 254

[1] Included under "Other States."
[2] 1944: Arizona (2 active plants), Arkansas (2), Colorado (1), Connecticut (1), Indiana (2), Louisiana (1), Maine (2), Michigan (2), Minnesota (1), Montana (1), Nevada (1), New Jersey (3), North Carolina (1), Oregon (1), South Dakota (1), Utah (2), Vermont (3), Washington (2), and Wisconsin (5). 1945: Arizona (1), Arkansas (1), Colorado (1), Connecticut (1), Florida (2), Indiana (1), Louisiana (1), Maine (2), Massachusetts (3), Michigan (2), Minnesota (1), Montana (1), Nevada (1), New Jersey (3), New York (3), North Carolina (1), Oregon (1), Puerto Rico (2), South Dakota (1), Utah (2), Vermont (3), Washington (2), and Wisconsin (6).

Uses.—There were no significant changes in the quantities of hydrated lime used for several of the major applications in 1945; but substantial increases are recorded in the quantities sold for insecticides, paper manufacture, petroleum refining, sewage treatment, and water purification.

Hydrated lime sold by producers in the United States, 1944–45, by uses

Use	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Agricultural	298, 026	$2, 391, 658	$8. 02	252, 881	$2, 078, 924	$8. 22
Building	393, 056	3, 261, 816	8. 30	434, 026	3, 762, 343	8. 67
Chemical and industrial:						
Bleach, liquid and powder	(1)	(1)	(1)	9, 275	79, 422	8. 56
Brick, silica	12, 124	102, 603	8. 46	12, 295	116, 618	9. 48
Coke and gas	2, 595	19, 727	7. 60	1, 819	14, 362	7. 90
Food products	14, 765	138, 604	9. 39	13, 889	138, 138	9. 95
Glass	2, 815	22, 985	8. 17	2, 834	23, 473	8. 28
Insecticides	50, 192	427, 127	8. 51	60, 233	538, 828	8. 95
Metallurgy	43, 750	356, 227	8. 14	37, 960	319, 628	8. 42
Paints	7, 444	62, 249	8. 36	7, 590	61, 050	8. 04
Paper mills	26, 069	199, 568	7. 66	30, 040	247, 508	8. 24
Petroleum	24, 863	235, 172	9. 46	34, 857	329, 502	9. 45
Sewage	14, 324	120, 900	8. 44	29, 241	242, 681	8. 30
Sugar	16, 752	198, 535	11. 85	15, 717	193, 637	12. 32
Tanneries	47, 445	363, 522	7. 66	44, 841	352, 624	7. 86
Water purification	168, 117	1, 327, 414	7. 90	181, 350	1, 497, 703	8. 26
Other uses	200, 681	1, 414, 537	7. 05	186, 180	1, 425, 813	7. 66
	631, 936	4, 989, 170	7. 90	668, 121	5, 580, 987	8. 35
Total hydrated lime	1, 323, 018	10, 642, 644	8. 04	1, 355, 028	11, 422, 254	8. 43

[1] Included under "Other uses."

TRENDS IN PRINCIPAL USES

Building-lime sales, which generally follow the trend of total new construction, failed to keep pace with it since 1939, as indicated in figure 1. Since that year war construction dominated all building activities, and the types of construction that prevailed required relatively little lime. It is apparent from the same figure that refractory lime (dead-burned dolomite) used for furnace linings and lime employed in the chemical and manufacturing industries follow closely the volume of industrial production.

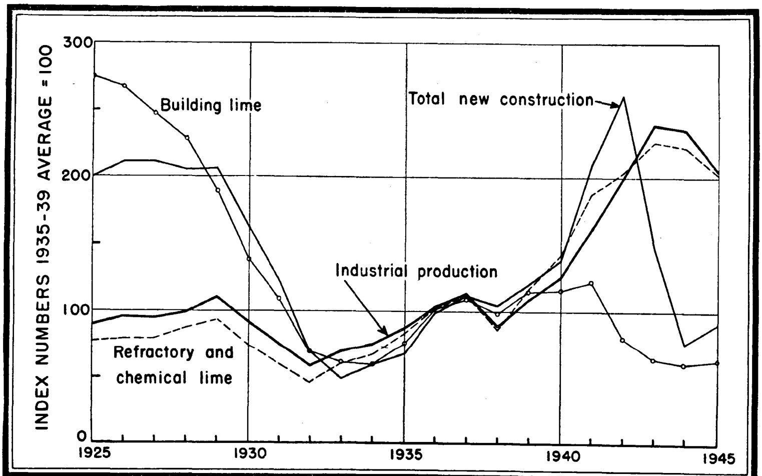

FIGURE 1.—Sales of refractory and building lime compared with total new construction and industrial production, 1925–45. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from the Bureau of Foreign and Domestic Commerce and on industrial production from the Federal Reserve Board.

Trends in sales of "open-market" lime for its principal uses during the past 21 years are indicated in figure 2. Chemical lime has continued the downward trend begun in 1944. Sales of refractory lime (dead-burned dolomite) have since 1925 followed a course closely

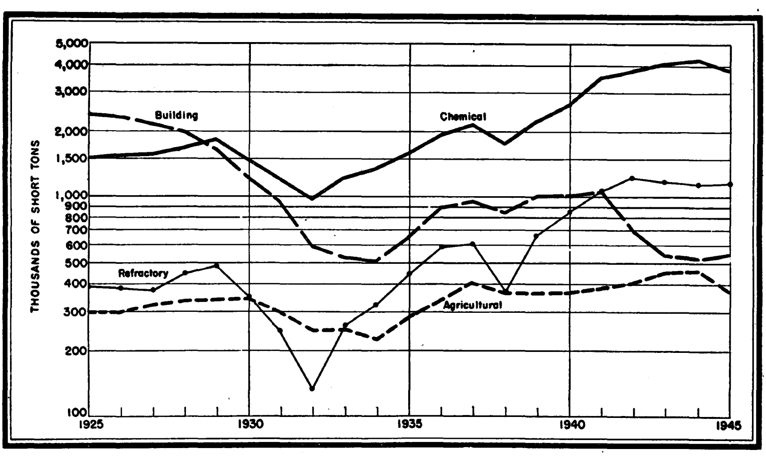

FIGURE 2.—Trends in major uses of lime, 1925–45.

paralleling that of chemical lime. Building lime has reversed its downward course. The volume of sales of agricultural lime was appreciably lower in 1945.

SHIPMENTS

Total shipments.—Output exceeded apparent consumption in 13 of the 36 lime-producing States in 1945. The excess of out-of-State over into-State movements was large only in Missouri, Ohio, Tennessee, and West Virginia.

Sales, shipments, and supplies of lime available for consumption in continental United States, by States and groups of States, are listed in the two following tables.

Lime supplies available in continental United States in 1945, by States, in short tons

State	Sales by producers	Shipments from State [1]	Shipments into State	Supply		
				Quicklime	Hydrated lime	Total
Alabama	315,559	97,016	38,580	241,536	15,587	257,123
Arizona	58,736	4,479	5,153	57,185	2,225	59,410
Arkansas	(2)	(2)	(2)	70,591	4,657	75,248
California	135,158	19,669	36,165	110,398	41,256	151,654
Colorado	(2)	(2)	(2)	33,875	4,686	38,561
Connecticut	(2)	(2)	(2)	18,724	11,641	30,365
Delaware	----------	----------	50,350	35,890	14,460	50,350
District of Columbia	----------	----------	7,944	862	7,082	7,944
Florida	18,431	----------	49,155	42,828	24,758	67,586
Georgia	3,864	910	68,578	50,157	21,375	71,532
Idaho	----------	----------	2,681	1,203	1,478	2,681
Illinois	287,607	126,601	241,906	321,267	81,645	402,912
Indiana	(2)	(2)	(2)	184,579	29,492	214,071
Iowa	----------	----------	62,824	47,446	15,378	62,824
Kansas	----------	----------	32,352	18,311	14,041	32,352
Kentucky	----------	----------	155,408	140,412	14,996	155,408
Louisiana	(2)	(2)	(2)	61,703	22,086	83,789
Maine	(2)	(2)	(2)	58,332	9,215	67,547
Maryland	66,675	17,199	121,174	112,794	57,856	170,650
Massachusetts	94,499	60,331	27,546	35,093	26,621	61,714
Michigan	(2)	(2)	(2)	185,340	56,008	241,348
Minnesota	(2)	(2)	(2)	59,783	11,914	71,697
Mississippi	----------	----------	16,332	11,445	4,887	16,332
Missouri	753,932	524,001	33,576	162,896	100,611	263,507
Montana	(2)	(2)	(2)	35,553	3,353	38,906
Nebraska	----------	----------	9,921	2,666	7,255	9,921
Nevada	(2)	(2)	(2)	23,053	1,786	24,839
New Hampshire	----------	----------	9,196	6,642	2,554	9,196
New Jersey	(2)	(2)	(2)	67,000	96,038	163,038
New Mexico	(2)	(2)	(2)	1,572	3,081	4,653
New York	(2)	(2)	(2)	249,624	93,334	342,958
North Carolina	(2)	(2)	(2)	42,904	29,547	72,451
North Dakota	----------	----------	7,068	426	6,642	7,068
Ohio	1,420,983	944,994	286,185	646,387	115,787	762,174
Oklahoma	(2)	(2)	(2)	12,287	9,401	21,688
Oregon	(2)	(2)	(2)	31,089	4,834	35,923
Pennsylvania	903,914	427,561	490,219	783,255	183,317	966,572
Rhode Island	----------	----------	8,650	4,274	4,376	8,650
South Carolina	----------	----------	9,447	3,010	6,437	9,447
South Dakota	(2)	(2)	(2)	1,454	2,543	3,997
Tennessee	207,587	172,834	12,752	17,009	30,496	47,505
Texas	105,277	38,210	22,207	55,076	34,198	89,274
Utah	47,484	2,053	9,152	49,582	5,001	54,583
Vermont	38,096	13,527	276	24,193	652	24,845
Virginia	118,707	74,454	80,633	82,319	42,567	124,886
Washington	(2)	(2)	(2)	17,710	8,194	25,904
West Virginia	511,509	448,748	175,271	221,142	16,890	238,032
Wisconsin	124,560	69,918	72,657	95,483	31,816	127,299
Wyoming	----------	----------	902	200	702	902
Undistributed [3]	692,383	341,298	1,205,898	----------	----------	----------
	5,904,961	3,383,803	3,350,158	4,536,560	1,334,756	5,871,316

[1] Includes 33,645 tons exported or unclassified as to destination.
[2] Included under "Undistributed."
[3] Includes items entered as "(2)."

Lime shipped (supply) in continental United States, in 1945, by origin and destination of shipments, in short tons

Destination	Origin														
	Illinois, Indiana, Michigan, Ohio			Maryland, New Jersey, New York, Pennsylvania, West Virginia			Connecticut, Maine, Massachusetts, Vermont			Florida, Georgia, North Carolina, Virginia			Alabama, Louisiana, Tennessee		
	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total	Quicklime	Hydrated lime	Total
Illinois, Indiana, Michigan, Ohio	917,076	215,791	1,132,867	130,604	9,166	139,770	--------	30	30	10,084	520	10,604	209	2,487	2,696
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	414,610	100,712	515,322	963,789	330,201	1,293,990	20,536	21,891	42,427	43,272	10,508	53,780	15,350	1,395	16,745
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	1,562	8,478	10,040	59,844	6,285	66,129	85,532	40,040	125,572	295	105	400	--------	30	30
Florida, Georgia, North Carolina, South Carolina, Virginia	6,920	29,837	36,757	41,133	19,600	60,733	--------	--------	--------	33,398	41,108	74,506	127,703	33,275	160,978
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	54,166	20,878	75,044	3,572	345	3,917	--------	--------	--------	--------	1,270	1,270	282,835	47,985	330,820
Arkansas, Kansas, Nebraska, Oklahoma, Texas	2,765	4,197	6,962	60	--------	60	--------	--------	--------	--------	--------	--------	11,113	--------	11,113
Iowa, Minnesota, Missouri, Wisconsin	41,315	33,431	74,746	--------	482	482	--------	--------	--------	--------	--------	--------	--------	1,538	1,538
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	6,459	1,503	7,962	220	--------	220	--------	--------	--------	--------	--------	--------	--------	--------	--------

Lime shipped (supply) in continental United States, in 1945, by origin and destination of shipments, in short tons—Continued

Destination	Origin											
	Arkansas, Oklahoma, Texas			Minnesota, Missouri, Wisconsin			Arizona, California, Colorado, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington			United States		
	Quick-lime	Hy-drated lime	Total	Quick-lime	Hy-drated lime	Total	Quick-lime	Hy-drated lime	Total	Quick-lime	Hy-drated lime	Total
Illinois, Indiana, Michigan, Ohio	427	728	1, 155	279, 142	54, 210	333, 352	31	----------	31	1, 337, 573	282, 932	1, 620, 505
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	----------	4	4	12, 945	4, 266	17, 211	65	----------	65	1, 470, 567	468, 977	1, 939. 544
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	----------	561	561	25	120	145	----------	----------	----------	147, 258	55, 619	202, 877
Florida, Georgia, North Carolina, South Carolina, Virginia	183	----------	183	11, 881	864	12, 745	----------	----------	----------	221, 218	124, 684	345, 902
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	39, 984	7, 641	47, 625	91, 548	9, 933	101, 481	----------	----------	----------	472, 105	88, 052	560, 157
Arkansas, Kansas, Nebraska, Oklahoma, Texas	113, 087	45, 643	158, 730	31, 901	19, 562	51, 463	5	150	155	158, 931	69, 552	228, 483
Iowa, Minnesota, Missouri, Wisconsin	26, 064	2, 052	28, 116	298, 228	121, 976	420, 204	1	240	241	365, 608	159, 719	525, 327
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	9, 705	3, 401	13, 106	5, 826	10, 904	16, 730	341, 090	69, 413	410, 503	363, 300	85, 221	448, 521

As indicated in the accompanying table, small quantities of lime are shipped from continental United States to various island Territories.

Lime shipped to noncontiguous Territories of the United States, 1942–45

Territory	1942		1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Hawaii	1,217	$16,034	1,170	$17,528	511	$8,197	246	$4,555
Puerto Rico	1,162	15,343	4	170	415	5,572	1,458	20,144
Virgin Islands	111	2,010	103	3,462	121	3,876	80	2,100

Hydrated-lime shipments.—The distribution of hydrated lime into groups of States from all producing plants and from Ohio, the most productive State, is listed in the following table.

Shipments of hydrated lime from plants in continental United States and in Ohio in 1945, by destinations

Destination	From all plants		From Ohio plants		
	Short tons	Distribution (percent)	Short tons	Distribution (percent)	Percent of total shipments
Illinois, Indiana, Michigan, Ohio	282,932	21	181,362	51	64
Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, West Virginia	468,977	35	100,398	28	21
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	55,619	4	8,478	2	15
Florida, Georgia, North Carolina, South Carolina, Virginia	124,684	9	29,837	8	24
Alabama, Kentucky, Louisiana, Mississippi, Tennessee	88,052	7	17,658	5	20
Arkansas, Kansas, Nebraska, Oklahoma, Texas	69,552	5	3,697	1	5
Iowa, Minnesota, Missouri, Wisconsin	159,719	12	16,123	5	10
Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington, Wyoming	85,221	6	1,283	(1)	2
Undistributed and exports	6,727	1	242	(1)	4
	1,341,483	100	359,078	100	27

[1] Less than 1 percent.

MILL VALUES

The net mill realization (excluding container cost) per ton of lime sold in the open market in 1945 averaged $7.76, a gain of 24 cents over 1944 and 49 cents over 1942. The gain in 1945 reflects the various upward price adjustments authorized by the OPA, as recorded in the introductory paragraphs of this report. As in 1944, the largest increase was in agricultural lime.

NEW DEVELOPMENTS

A new type of calcining unit, known as the "Nelson," that has been used in two lime plants in Mexico, was introduced in a lime plant at Provo, Utah, in 1945. This is the first installation on record of such equipment in the United States. The unit is an inclined stationary furnace having a 35° slope. It is said to require little power or supervision and to be economical of fuel. Operating records show that in experimental runs before all mechanical difficulties were overcome the oil consumption per ton of lime was little more than half of the average consumption in United States oil-burning kilns.

The National Lime Association is sponsoring a fellowship at the National Bureau of Standards for continued research on masonry mortars, formerly conducted at the Massachusetts Institute of Technology. These studies are gradually establishing the fundamental characteristics of a mortar that will furnish a strong, permanent, waterproof bond.

SIZE OF PLANTS

The following table presents a grouping of lime plants according to size. The progressive decline in the number of plants operating continued in 1945. The 189 producers in 1945 contrast strikingly with the 450 in 1925, when production was only about three-fourths as great. The decline in the number of active plants is most pronounced in the groups of smaller operations, particularly in the group producing 1,000 to 5,000 tons a year.

Distribution of lime (including refractory) plants, 1943–45, according to size of production

Size group (short tons)	1943			1944			1945		
	Plants	Production		Plants	Production		Plants	Production	
		Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total
Less than 1,000	40	15,397	(1)	25	10,929	(1)	27	11,448	(1)
1,000 and less than 5,000	61	164,490	2	45	120,763	2	38	109,488	2
5,000 and less than 10,000	22	170,838	3	28	194,032	3	22	153,868	3
10,000 and less than 25,000	41	644,329	10	35	532,642	8	29	480,582	8
25,000 and less than 50,000	41	1,497,984	23	35	1,267,897	20	35	1,267,909	21
50,000 and less than 100,000	24	1,549,527	23	27	1,788,065	28	24	1,544,176	26
100,000 and over	16	2,554,050	39	15	2,559,235	39	14	2,353,108	40
	245	6,596,615	100	210	6,473,563	100	189	5,920,579	100

[1] Less than 1 percent.

FOREIGN TRADE [1]

Imports.—Lime imports are confined principally to movements from Canada to points in the State of Washington.

Lime imported for consumption in the United States, 1941–45

Year	Hydrated lime		Other lime		Dead-burned dolomite [1]		Total	
	Short tons [2]	Value	Short tons [2]	Value	Short tons	Value	Short tons	Value
1941	808	$8, 827	11, 747	$100, 127	64	$654	12, 619	$109, 608
1942	655	6, 722	7, 445	66, 893	449	11, 260	8, 549	84, 875
1943	740	6, 670	13, 911	119, 358	739	22, 563	15, 390	148, 591
1944	380	3, 323	17, 368	147, 406	40	691	17, 788	151, 420
1945	677	6, 501	20, 108	172, 676	73	33	20, 858	179, 210

[1] "Dead-burned basic refractory material containing 6 percent or more of lime and consisting chiefly of magnesia and lime."
[2] Includes weight of immediate container.

Lime imported for consumption in the United States, 1943–45, by countries and customs districts [1]

Country	Customs district	1943		1944		1945	
		Short tons [2]	Value	Short tons [2]	Value	Short tons [2]	Value
Canada	Buffalo	120	$882	80	$556		
	Maine and New Hampshire					26	$352
	Michigan					1	6
	Oregon	40	336	52	434	40	334
	St. Lawrence					20	91
	San Francisco					1	26
	Vermont	2	21				
	Washington	14, 489	124, 789	17, 616	149, 739	20, 697	178, 368
		14, 651	126, 028	17, 748	150, 729	20, 785	179, 177

[1] Exclusive of dead-burned basic refractory material.
[2] Includes weight of immediate container.

Exports.—Exports of lime are small and confined almost exclusively to Canada and the Latin American countries.

Lime exported from the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	46, 500	$475, 540	1944	22, 689	$216, 642
1942	36, 061	400, 845	1945	24, 276	268, 875
1943	23, 284	255, 135			

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Lime exported from the United States, 1943–45, by countries

Country	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	22	$870	6	$321	6	$187
Bahamas	6	125	51	892	97	2,633
Brazil	11	473	68	1,471	22	1,196
Canada	8,930	70,735	7,507	35,816	8,379	48,721
Chile	15	293	54	1,346	6	371
Colombia	30	483	8	163	14	406
Costa Rica	2,913	35,309	1,473	18,235	38	415
Cuba	37	511	33	404	38	692
Curaçao (N. W. I.)	74	762	22	440	50	677
Dominican Republic	149	2,749	114	1,081	20	188
El Salvador	39	678	83	1,673	49	1,179
Haiti	862	10,647	566	7,007	363	4,686
Honduras	6,489	83,531	7,811	84,320	6,017	69,758
Liberia	57	1,353	25	699	39	1,318
Mexico	1,260	14,778	2,010	28,969	4,587	73,734
Nicaragua	188	3,501	107	2,231	127	2,632
Panama, Republic of	1,908	23,351	2,586	26,177	3,715	38,955
Peru	154	2,420	74	1,221	278	4,299
United Kingdom	----------	----------	38	1,854	170	8,342
Other countries	140	2,566	53	2,322	261	8,486
	23,284	255,135	22,689	216,642	24,276	268,875

CLAYS

By G. W. Josephson and A. Linn [1]

SUMMARY OUTLINE

GENERAL SUMMARY

Coming as it did in the middle of the year, the effect of the end of the war was only partly visible in the statistics of the clay industry in 1945. Sales of some types, such as rubber clay, increased sharply, but more time will be required to fully reveal the reactions of others. Total output of clay in 1945 was 9 percent greater than in 1944.

Output of kaolin, ball clay, fuller's earth, bentonite, and the common clays increased from 1 to 20 percent; a new record was attained by bentonite. Kaolin benefited from the sudden demand for rubber clay that developed immediately after the end of hostilities. Increased demand from the pottery industry bolstered ball-clay sales. Fuller's earth was still on an upward trend, supported by good demand in the oil industries and expansion of the new uses as absorbents. With the revival of building construction, the production of the common clays began to rise from the low levels reached during the war.

During the early part of the year clay producers held a relatively low priority position, but they were given special consideration by the War Production Board during the latter part.

Prices were under the control of the Office of Price Administration during 1945. In certain cases price increases were authorized for specific products and areas, and a general increase was approved for brick and tile.

Care must be exercised in correlating the clay statistics recorded in this chapter with those published in Minerals Yearbooks prior to 1944. The relationship of the present figures to the previous series is outlined in the clays chapter of Minerals Yearbook, 1944.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Salient statistics of the clay industry in the United States, 1944–45

	1944		1945	
	Short tons	Value	Short tons	Value
Domestic clay sold or used by producers:				
Kaolin or china clay	873,056	$7,858,740	939,988	$9,072,927
Ball clay	155,667	1,376,096	174,524	1,589,875
Fire clay, including stoneware clay	6,344,383	14,167,118	6,090,411	15,587,034
Bentonite	546,768	3,605,988	573,998	3,770,625
Fuller's earth	294,737	3,297,064	296,368	3,463,913
Miscellaneous clays	9,080,717	6,550,269	10,848,686	9,774,854
	17,295,328	36,855,275	18,923,975	43,259,228
Imports:				
Kaolin or china clay	45,890	487,237	57,497	871,541
Common blue and Gross-Almerode	17,597	159,006	17,852	184,554
Fuller's earth	308	4,284	336	4,647
Other clay	2,712	10,602	1,636	9,078
	66,507	661,129	77,321	1,069,820
Exports:				
Kaolin or china clay	(1)	(1)	12,402	130,977
Fire clay	87,741	571,670	94,602	630,751
Other clay (including fuller's earth)	[1] 93,463	[1] 1,493,367	77,436	1,494,479
	181,204	2,065,037	184,440	2,256,207

[1] Not separately classified prior to Jan. 1, 1945; included with "Other clays."

FUTURE OUTLOOK

During the last few months of 1945 the predicted postwar demand for building construction became a reality. The need for more adequate housing unquestionably exists, and the means of satisfying it are being provided by personal savings, credit, and huge Government appropriations. As it will take years to complete the program, the output of common clays will probably be high for an extended period. Competition with other materials is a factor that may become serious, but it appears that in the immediate future the market will absorb virtual capacity production of structural clay products.

On the other hand, output of fire clay is likely to remain between the wartime and prewar levels. Probably fewer new furnaces will be constructed than during the war, but maintenance should provide a good market.

Bentonite has established so many consecutive new records that further growth seems the only logical conclusion. However, such a large portion of total sales is for use in foundries and rotary drilling that any substantial decline in those activities can interrupt the current rise in bentonite output.

Kaolin and ball clay have good peacetime markets, so sales should be large for some time to come, particularly if competition from foreign clays does not reach serious proportions.

The trend of output of fuller's earth is less predictable. Sales to oil refiners have been relatively stable, and the expansion has been in uses as absorbents. This market is in an early stage of development, so will probably grow; however, there may be a limited period of recession, if machine-shop activity declines, until promotion of wider use in industry is successful.

CONSUMPTION AND USES

The tonnages shown in the accompanying table were compiled from reports of sales by producers for consumption in the various uses indicated. These figures are comparable with similar statistics published in Minerals Yearbook, 1944, and those of kaolin, ball clay, bentonite, and fuller's earth are comparable for previous years as well. Some of the fire clay and miscellaneous clay figures are not comparable with those published prior to 1944, owing to exclusion of captive tonnage in the earlier years. The relationship is outlined in greater detail in the Clays chapter of Minerals Yearbook, 1944.

Clay sold or used by producers in the United States in 1945, by kinds and uses, in short tons

Use	Kaolin	Ball clay	Fire clay and stoneware clay	Bentonite	Fuller's earth	Miscellaneous clay including slip clay	Total
Pottery and stoneware:							
Whiteware, etc.	73,613	156,739	6,590				236,942
Stoneware, including chemical stoneware			33,241			1,000	34,241
Art pottery and flower pots	449	1,680	14,625			31,931	48,685
Slip for glazing						279	279
	74,062	158,419	54,456			33,210	320,147
Tile, high grade	9,544	8,017	85,750			8,397	111,708
Kiln furniture:							
Saggers, pins, stilts	4,680	1,318	25,273				31,271
Wads			3,833				3,833
	4,680	1,318	29,106				35,104
Architectural terra cotta		1,962	2,343				4,305
Paper:							
Filler	362,323		285				362,608
Coating	188,029						188,029
	550,352		285				550,637
Rubber	109,936		7,800				117,736
Linoleum and oilcloth	14,593		3,411				18,004
Paints:							
Filler or extender	21,092		233				21,325
Calcimine	500						500
	21,592		233				21,825
Cement manufacture	13,586	134	15	2,115		3,144,547	3,160,397
Refractories:							
Fire brick and block	85,261	2,000	3,408,721				3,495,982
Bauxite, high alumina brick			67,654				67,654
Fire-clay mortar, including clay processed for laying fire brick	2,785		187,572				190,357
Clay crucibles	252		2,394				2,646
Glass refractories	91		10,536				10,627
Zinc retorts and condensers			46,980				46,980
Foundries and steelworks	2,314		729,073	161,907		22,275	915,569
	90,703	2,000	4,452,930	161,907		22,275	4,729,815
Heavy-clay products: Common brick, face brick, paving brick, drain tile, sewer pipe, and kindred products	1,021		1,331,942			7,201,521	8,534,484
Miscellaneous:							
Rotary drilling mud			753	162,418	11,608	217,087	391,866
Filtering and decolorizing oils (raw and activated earths)				145,749	[1] 219,576		365,325
Other filtering and clarifying				4,307	6,601		10,908
Artificial abrasives	6,051		1,358			3,015	10,424
Asbestos	1,620					676	2,296

[1] Comprises following: Mineral oils, 192,473 tons; vegetable oils, 27,103 tons.

Clay sold or used by producers in the United States in 1945, by kinds and uses, in short tons—Continued

Use	Kaolin	Ball clay	Fire clay and stoneware clay	Bentonite	Fuller's earth	Miscellaneous clay including slip clay	Total
Miscellaneous—Continued							
Chemicals	11,724		68,895	692			81,311
Enameling		500					500
Filler (other than paper or paint)	3,374			2,160	150	10,217	15,901
Plaster and plaster products	7,242						7,242
Concrete admixture, sealing dams, etc				1,399			1,399
Absorbent uses					57,700		57,700
Other uses	19,908	2,174	51,134	93,251	733	207,741	374,941
	49,919	2,674	122,140	409,976	296,368	438,736	1,319,813
Grand total:							
1945	939,988	174,524	6,090,411	573,998	296,368	10,848,686	18,923,975
1944	873,056	155,667	6,344,383	546,768	294,737	9,080,717	17,295,328

CHINA CLAY OR KAOLIN

As shown on the accompanying chart, the output of kaolin reached a record of 1,087,848 short tons in 1941 and then declined gradually during the following 3 years. In 1945 the trend was reversed, and kaolin output was 8 percent larger than in 1944.

Production was reported from 10 States in 1945, but 92 percent of the total came from 2. Georgia furnished 75 percent and South Carolina 17; most of the remainder came from North Carolina, Florida, and Pennsylvania.

Kaolin has a wide variety of use. Its principal markets are in the paper, rubber, refractory, and pottery industries. In 1945, 59 percent of the total was used as paper filler and coating, 12 in rubber, 10 in refractories, and 8 in pottery.

Consumption of paper clays declined during the war owing to high production of the darker types of paper, but in 1945 sales increased by nearly 34,000 tons and were within 9 percent of the record set in 1941.

When the Japanese cut off our supply of natural rubber, the consumption of rubber clay dropped from 127,055 tons in 1941 to 50,964 in 1943. Part of the decline was due to actual shortage of rubber and later to the fact that the compounding of synthetic rubber requires more carbon black and relatively smaller amounts of kaolin than does natural rubber. But equally important were the wartime restrictions on the manufacture of some nonessential types of mechanical goods and emphasis on high strength rather than attractive appearance for all rubber goods.

At the end of the war manufacturers again turned their attention to the civilian market. The output of mechanical goods increased. In addition, in order to produce rubber goods in the attractive light colors that enhance sales appeal, more clay was added to those that had been in production throughout the war. Consequently, sales of rubber clay increased greatly in the latter part of 1945, and the total for the year exceeded that of 1944 by 84 percent.

The tonnage of kaolin used for refractories totaled 159,886 in 1942, but by 1945 it had declined to 90,703. There is less new furnace construction than in 1942, but maintenance still offers a substantial market.

Consumption of kaolin in pottery in 1945 was 12 percent lower than in 1944.

Prices of kaolin quoted in trade journals were stable during 1945. Sagger clays sell for as little as $2.50 per ton, but most of the processed types are priced between $6 and $25. A few sell as high as $40. English china clay was quoted at $19 to $28 for lump and from $40 up for powdered. The national average value, as reported by producers to the Bureau of Mines, was $9.65 per ton in 1945—substantially higher than the $9 reported in 1944.

Imports of china clay increased 25 percent in 1945, but were less than half as large as the 122,232 tons averaged in 1935–39. A total of less than 3 tons was reported from Canada, Liberia, and Union of South Africa and the rest came from England. Strong competition from English china clay had not yet developed owing to labor shortages and good demand in Britain, but a vigorous effort by the English producers to recapture their American market can be expected. During the war their output was restricted by diversion of manpower to direct war production, and some mines were closed. Many of these have been reopened, operators furnished with equipment, and representatives sent overseas. Britain greatly needs foreign exchange, and as kaolin has ranked second only to coal as a raw material export, the British Government is encouraging this trade as well as assisting the expansion of her pottery industry.

Before January 1, 1945, exports of kaolin from the United States were not separately classified, but the United States Department of Commerce reports that 12,402 short tons of kaolin or china clay valued at $130,977 were exported in 1945.

Kaolin sold or used by producers in the United States, 1944–45, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Alabama	(1)	(1)			(1)	(1)
California	6,392	$81,440	2,070	$6,827	8,462	$88,267
Florida	(1)	(1)			(1)	(1)
Georgia	598,822	5,551,549	75,578	271,875	674,400	5,823,424
Illinois	(1)	(1)			(1)	(1)
North Carolina	(1)	(1)			(1)	(1)
Pennsylvania	15,501	61,245			15,501	61,245
South Carolina	118,634	1,068,476			118,634	1,068,476
Utah	(1)	(1)			(1)	(1)
Vermont	(1)	(1)			(1)	(1)
Virginia	(1)	(1)			(1)	(1)
Undistributed [2]	56,059	817,328			56,059	817,328
	795,408	7,580,038	77,648	278,702	873,056	7,858,740
1945						
Alabama	(1)	(1)			(1)	(1)
California	6,385	72,418	1,901	8,182	8,286	80,600
Florida	(1)	(1)			(1)	(1)
Georgia	629,531	6,278,411	72,857	406,116	702,388	6,684,527
Illinois	(1)	(1)			(1)	(1)
North Carolina	(1)	(1)			(1)	(1)
Pennsylvania	13,965	50,589			13,965	50,589
South Carolina	159,550	1,467,328			159,550	1,467,328
Utah	(1)	(1)			(1)	(1)
Virginia	(1)	(1)			(1)	(1)
Undistributed [2]	55,799	789,883			55,799	789,883
	865,230	8,658,629	74,758	414,298	939,988	9,072,927

[1] Included under "Undistributed." [2] Figures include States indicated by "(1)" above.

Georgia kaolin sold or used by producers, 1941–45, by uses

Year	China clay, paper clay, etc.			Refractory uses			Total kaolin		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton		Total	Average per ton
1941	669,978	$6,216,087	$9.28	117,035	$357,518	$3.05	787,013	$6,573,605	$8.35
1942	594,780	5,645,760	9.49	149,628	490,471	3.28	744,408	6,136,231	8.24
1943	596,075	5,810,922	9.75	136,515	421,650	3.09	732,590	6,232,572	8.51
1944	579,922	5,545,045	9.56	94,478	278,379	2.95	674,400	5,823,424	8.63
1945	616,736	6,305,132	10.22	85,652	379,395	4.43	702,388	6,684,527	9.52

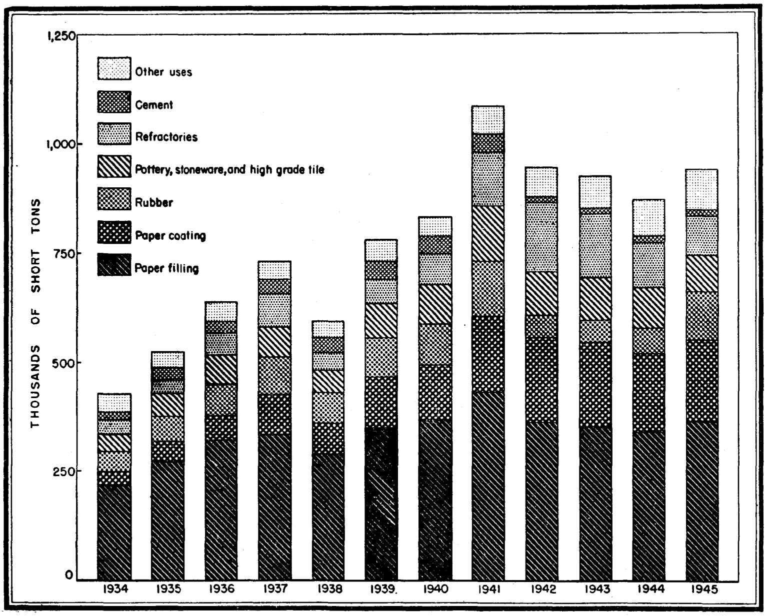

FIGURE 1.—Kaolin sold by domestic producers for specified uses, 1934–45.

BALL CLAY

The highest output of ball clay in the United States was attained in 1941, when sales totaled 198,445 short tons. After 2 years of decline, volume increased moderately in 1944, and this upward trend continued in 1945. Sales in 1945 were 12 percent greater than in 1944 and were the second highest on record.

Almost equal quantities of ball clay were produced in Tennessee and Kentucky, and together they comprised 93 percent of the total output in the United States in 1945.

Prices of domestic ball clay quoted in trade journals ranged from $3 to $18.25, depending upon quality and degree of preparation. The average value reported by producers to the Bureau of Mines has been increasing gradually during the past few years and in 1945 was $9.11 per short ton, which compares with $8.84 in 1944.

Although relatively small quantities are consumed in refractories, tile, and other uses, 91 percent of total sales are reported to be consigned to the producers of pottery.

Imports under the classification of "common blue and ball clays" totaled 17,824 short tons valued at $183,717—approximately the same quantity as in 1944. It was all "unwrought and unmanufactured" English ball clay. Foreign ball clays still enjoy a good reputation in the United States, but domestic substitutes have served satisfactorily during the war. Although English ball-clay producers desire to regain their prewar volume of sales in the United States, they have encountered difficulties. The English ball-clay mines are not highly mechanized, and consequently output can be expanded rapidly only by increasing the working force. Labor was scarce in England in 1945, so clay production was limited. Local demand was high, and rehabilitation programs that have been planned by the British Government probably will take even greater quantities in the future. Studies were made of the possibilities of mechanization, and German methods were investigated by a team consisting of mine owners and technicians.

Similarly, German producers of Vallendar clay would like to regain the market they once served in the United States. These mines, located near Coblenz, also are worked by selective methods, principally in open pits, but they have more mechanical equipment than is commonly employed in the English ball-clay mines. The deposits, which may be as much as 100 feet thick, are stripped with a bucket excavator, and the clay is mined by cutting it into blocks with spades or a plowlike cutter. These blocks usually are shipped immediately or dried in racks in an open-walled shed. Only a very small percentage is dried artificially. When the territory was overrun by our troops, production stopped and remained virtually at a standstill during the remainder of the year. Some mines were maintained but some became flooded. Efforts were being made to resume production because the clay was needed in neighboring countries, but at the end of the year the operating program for these mines was uncertain.

Ball clay sold by producers in the United States, 1943–45, by States

State	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Kentucky	69,982	$622,309	72,729	$669,419	80,077	$744,599
Maryland	(1)	(1)	(1)	(1)	(1)	(1)
Missouri	(1)	(1)				
New Jersey	(1)	(1)	(1)	(1)	(1)	(1)
Tennessee	70,606	593,657	73,339	624,297	82,835	752,289
Undistributed [2]	7,197	55,508	9,599	82,380	11,612	92,987
	147,785	1,271,474	155,667	1,376,096	174,524	1,589,875

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

FIRE CLAY

The output of fire clay declined 4 percent in 1945 and totaled about three-fourths as much as was produced in the record year of 1942. Before the war the refractories industry operated at less than

50 percent of capacity; but, as the demand for new furnaces grew, by 1942 it was producing virtually at capacity. Since then volume has declined as building programs were completed. However, the market has not decreased to the prewar level, because high industrial activity requires a large quantity of refractories for maintenance and normal expansion.

Fire-clay deposits are widely distributed, but market and quality considerations concentrate activity in a comparatively few States. In 1945 Ohio supplied 26 percent of the total, Pennsylvania 22, and Missouri 18; the remaining 34 percent was reported from 26 States. A map showing locations of fire-clay mines in the United States was published in the Clays chapter of Minerals Yearbook, 1941.

Fire clay, including stoneware clay,[1] sold or used by producers in the United States, 1944–45, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Alabama	(2)	(2)	(2)	(2)	101,265	$188,974
Arkansas	(2)	(2)	(2)	(2)	84,659	190,161
California	226,411	$508,922	125,406	$176,736	351,817	685,658
Colorado	38,054	94,182	37,808	66,910	75,862	161,092
Illinois	192,242	275,259	86,678	129,872	278,920	405,131
Indiana	58,859	77,142	37,457	61,426	96,316	138,568
Kentucky	73,045	293,517	301,532	808,885	374,577	1,102,402
Maryland	(2)	(2)	(2)	(2)	96,774	230,459
Missouri [3]	275,085	613,226	940,088	1,540,325	1,215,173	2,153,551
New Jersey	(2)	(2)	(2)	(2)	101,113	566,220
Ohio	535,186	1,139,347	1,062,360	2,167,534	1,597,546	3,306,881
Pennsylvania	274,805	784,679	1,104,229	2,804,780	1,379,034	3,589,459
Tennessee	(2)	(2)	(2)	(2)	17,163	91,275
Texas	(2)	(2)	(2)	(2)	104,771	299,808
Utah	(2)	(2)	(2)	(2)	10,415	26,091
Washington	7,008	11,701	65,029	107,819	72,037	119,520
West Virginia	64,545	132,136	251,573	681,945	316,118	814,081
Other States [4]	222,446	946,856	364,537	743,919	70,823	97,787
	1,967,686	4,876,967	4,376,697	9,290,151	6,344,383	14,167,118
1945						
Alabama	78,805	145,654	10,798	40,883	89,603	186,537
Arkansas	(2)	(2)	(2)	(2)	87,570	273,117
California	187,534	508,169	83,668	148,827	271,202	656,996
Colorado	44,338	80,555	38,122	67,942	82,460	148,497
Illinois	157,617	426,212	84,383	144,364	242,000	570,576
Indiana	86,078	111,305	51,118	84,036	137,196	195,341
Kentucky	49,890	230,309	286,712	798,890	336,602	1,029,199
Maryland	12,680	83,834	35,853	103,560	48,533	187,394
Missouri [3]	241,406	480,251	848,678	1,656,604	1,090,084	2,136,855
New Jersey	83,239	510,572	50,957	121,430	134,196	632,002
Ohio	563,032	1,091,576	1,050,038	2,336,588	1,613,070	3,428,164
Pennsylvania	285,962	792,067	1,072,867	3,640,900	1,358,829	4,432,967
Tennessee	(2)	(2)	(2)	(2)	21,474	109,266
Texas	(2)	(2)	(2)	(2)	107,166	360,054
Utah	(2)	(2)	(2)	(2)	8,762	21,432
Washington	(2)	(2)	(2)	(2)	63,812	113,466
West Virginia	53,933	115,342	214,087	823,243	268,020	938,585
Other States [5]	30,803	153,350	387,813	890,571	129,832	166,586
	1,875,317	4,729,196	4,215,094	10,857,838	6,090,411	15,587,034

[1] Includes stoneware clay as follows: 1944: 70,385 tons, $113,894; 1945: 98,309 tons, $186,589.
[2] Included under "Other States."
[3] Includes diaspore and burley clay as follows: 1944: Diaspore, 46,659 tons, $301,356; burley, 60,775 tons, $152,626; 1945: Diaspore, 20,635 tons, $166,501; burley, 37,472 tons, $86,913.
[4] 1944: Includes States indicated by (2) above, and Delaware, Georgia, Idaho, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Mexico, North Carolina, North Dakota, Oregon, South Carolina, and Virginia.
[5] 1945: Includes States indicated by (2) above, and Delaware, Idaho, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New Mexico, North Carolina, North Dakota, Oregon, and South Carolina.

As shown in the table in the Consumption and Uses section of this chapter, fire clays have a wide variety of uses. In 1945, 73 percent of the total tonnage was used in refractories and 22 percent in heavy-clay products. Refractory use declined 10 percent, whereas consumption in heavy-clay products increased 21 percent.

The average value of fire clay sold on the open market in 1945 was $2.52, as compared with $2.48 reported in 1944. Producers estimated the average value of captive tonnage at $2.58, considerably higher than in 1944 ($2.12). It is difficult to account for this increase, but it probably reflects higher operating costs.

Exports of fire clay totaled 94,602 short tons in 1945—approximately the level maintained during the past several years. Imports were limited to 28 tons valued at $837 from Brazil; they are reported to have been Gross Almerode clay.

BENTONITE

Breaking sales records has become virtually a habit of bentonite producers. In 1945, for the seventh consecutive year, more bentonite was sold or used by producers than in any previous year. Output in 1945 exceeded the 1944 tonnage by 5 percent and tripled that of 1938.

The major markets for bentonite have been developed in the foundry and petroleum industries. Sales for use as a foundry-sand bond increased steadily during the war but declined 11 percent in 1945, when reconversion reduced foundry activity.

On the other hand, sales to the petroleum industry for use in drilling muds, required to control gas pressures, increased 34 percent in 1945, more than compensating for the loss of foundry business. Approximately 28 percent of the total output was used for drilling mud and the same percentage for foundries. A little over 25 percent was used for oil filtering and decolorizing and the remainder in a wide variety of uses.

Almost 66 percent of the total output comes from the Wyoming-South Dakota area; 35 percent was produced in Wyoming and 31 percent in South Dakota.

In crude form bentonite may not sell for more than $2 to $3 per ton, but most of it is sold in prepared form at higher prices. Trade-journal quotations are: Dried and crushed, in bulk, $7.50; pulverized, 200 mesh, bagged, $9.50 to $11; pulverized 325 mesh, bagged, $16. The average value, as reported by producers to the Bureau of Mines, declined slightly, from $6.60 in 1944 to $6.57 in 1945. The average value of the material that is sold by producers has declined from $7.50 in 1943 to $7.29 in 1945.

At one time the American market was served by foreign as well as domestic bentonite, but this is no longer true. No imports were recorded by the United States Department of Commerce in 1945. Exports of bentonite are not recorded separately; producers reported to the Bureau of Mines, however, that they exported 14,684 tons to Canada, Mexico, Britain, Australia, Switzerland, Belgium, Africa, and various South American countries. This figure does not include dealer exports or acid-treated bentonite shipped to foreign oil refineries.

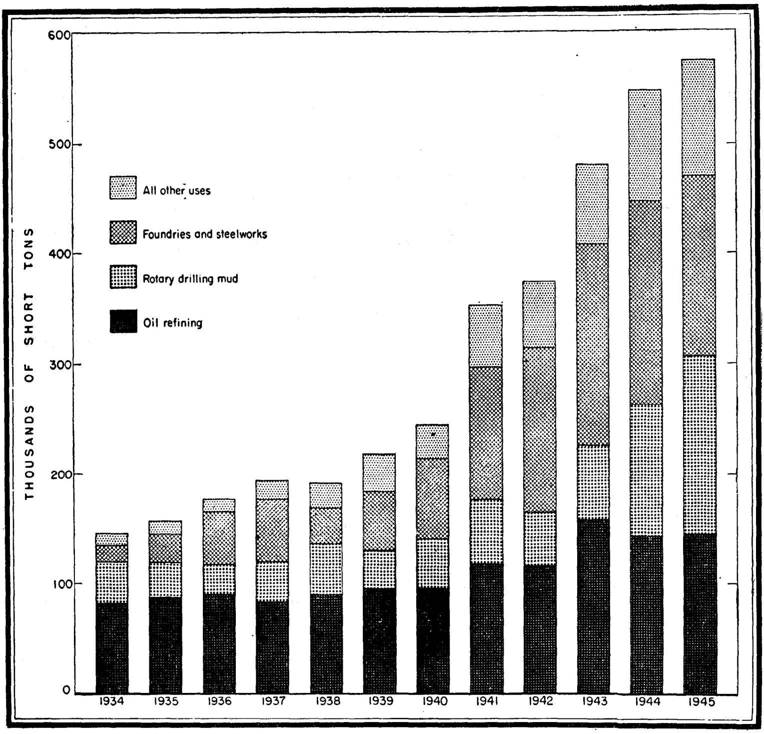

FIGURE 2.—Bentonite sold or used by domestic producers for specified uses, 1934–45.

Bentonite sold or used by producers in the United States, 1944–45, by States

State	Sold by producer		Used by producer		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Arizona	(1)	(1)			(1)	(1)
California	(1)	(1)	(1)	(1)	6,649	$60,404
Mississippi	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	169,893	$1,104,919			169,893	1,104,919
Texas	(1)	(1)	(1)	(1)	24,081	216,861
Utah	(1)	(1)			(1)	(1)
Wyoming	196,138	1,711,193			196,138	1,711,193
Undistributed [2]	87,606	531,023	93,131	$258,853	150,007	512,611
	453,637	3,347,135	93,131	258,853	546,768	3,605,988
1945						
Arizona	(1)	(1)			(1)	(1)
California	(1)	(1)	(1)	(1)	16,187	145,424
Colorado	(1)	(1)			(1)	(1)
Mississippi	(1)	(1)	(1)	(1)	(1)	(1)
Montana	(1)	(1)			(1)	(1)
South Dakota	178,374	1,202,555			178,374	1,202,555
Texas	(1)	(1)	(1)	(1)	24,503	247,940
Utah	(1)	(1)			(1)	(1)
Wyoming	199,293	1,686,912			199,293	1,686,912
Undistributed [2]	115,033	700,184	81,298	180,974	155,641	487,794
	492,700	3,589,651	81,298	180,974	573,998	3,770,625

[1] Included under "Undistributed."
[2] Figures include States indicated by "(1)."

FULLER'S EARTH

The upward trend in output of fuller's earth that began in 1941 continued through 1945, but the rate of increase was reduced. In 1945 approximately 1 percent more fuller's earth was sold or used than in 1944.

As shown in the accompanying chart, wartime demand has doubled the use of fuller's earth since the low year 1940. Expansion in consumption of filtering, decolorizing, and catalyzing materials by the oil industries was helpful, but the greatest increase in demand came from a newly developed market—as an absorbent.

The floors of machine shops are notoriously oily and slippery, and this condition is a constant source of accidents. As fuller's earth was known to have exceptional oil-absorbing properties it was applied experimentally to such floors, with very good results. Not only will it remove the free oil on the surface, but when left on as a floor covering it will even draw accumulated oil out of the floor itself by capillary action. In addition to providing an anti-skid floor that prevents accidents, it reduces the fire hazard and improves visibility in the plant by serving as a light-colored nonglare carpet.

The product was offered in about 1942 and was an immediate success. Sales increased steadily to 57,700 tons in 1945. The market has been expanded by finding a variety of new applications. Not only is it effective on oil and grease, but also syrups, solvents, acids, and other liquids are absorbed. It is even claimed to have virtue as

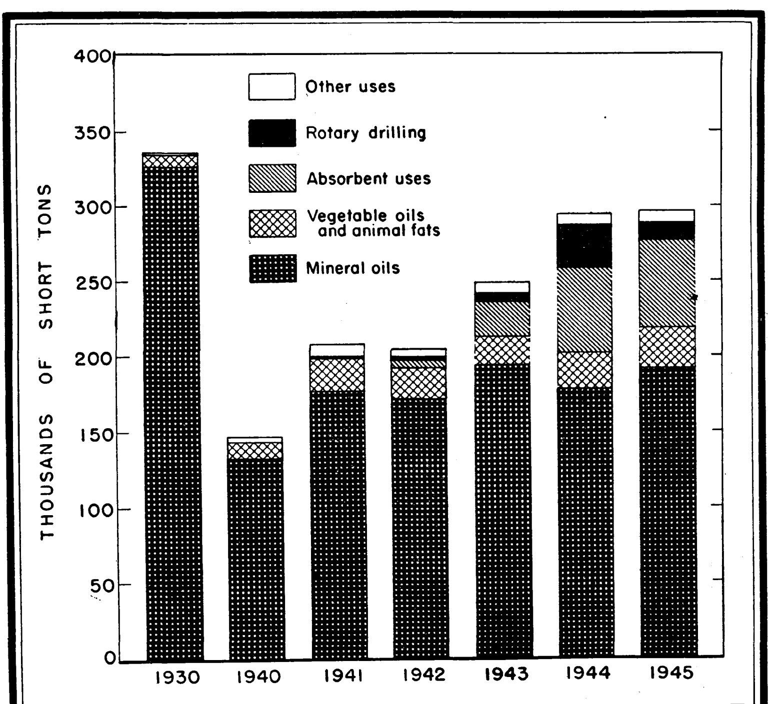

FIGURE 3.—Fuller's earth sold or used by producers for specified uses, 1930 and 1940–45.

a deodorant. The potential market is large. By 1945, uses as an absorbent accounted for 19 percent of total sales of fuller's earth. The petroleum industry took 65 percent for filtering and decolorizing oils and greases, and 9 percent was used for vegetable- and animal-oil processing.

The high quality of fuller's earth from the Georgia-Florida district is indicated by its relatively high value. In 1945, Georgia-Florida reported 45 percent of the total tonnage and 56 percent of the value. Texas, with 35 percent of the total, reported more output than any other State.

Trade-journal quotations of fuller's earth prices were as follows: Georgia and Florida, 30- to 60-mesh, $14.50 per short ton; 15- to 30-, $14; 200- up, $10; and 100- up, $7. Texas material is listed at $12.50 per ton at the mine, but most of it is sold for less than this figure. Imported earth was quoted at $30 to $40 per ton.

The United States Department of Commerce reports that 336 short tons of fuller's earth valued at $4,647 were imported from the United Kingdom in 1945. Exports are not classified separately, but producers reported to the Bureau of Mines that in 1945 they shipped 6,753 short tons valued at $72,135 to Canada, Belgium, Sweden, England, Persian Gulf, and various countries in South America.

Fuller's earth sold or used by producers in the United States, 1943–45, by States

State	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Florida and Georgia	105, 647	$1, 444, 936	128, 654	$1, 833, 682	134, 401	$1, 939, 035
Illinois	39, 500	372, 024	42, 277	390, 346	43, 664	403, 084
Texas	94, 137	728, 141	111, 212	916, 159	103, 076	931, 878
Other States [1]	7, 974	118, 926	12, 594	156, 877	15, 227	189, 916
	247, 258	2, 664, 027	294, 737	3, 297, 064	296, 368	3, 463, 913

[1] Includes California, Nevada, Tennessee, and Utah.

MISCELLANEOUS CLAYS

The various types of clay in the foregoing sections of this chapter are classified according to a practical pattern of composition and use that has grown up over a period of years. There remains a very large tonnage of clay and shale of uncertain or divergent specifications that is used in making heavy-clay products and portland cement. With these are grouped, in this "Miscellaneous" section, relatively minor quantities of slip clay, oil-well drilling mud, pottery clay, and small tonnages that find other special uses.

As demand for cement and heavy-clay products by the building industry began to grow following the cessation of hostilities, the production of miscellaneous clays increased, with output for 1945 reaching a total 19 percent above that for 1944.

Most of these clays are dug mechanically in open pits, and their value as raw clay at captive operations is usually less than $1 per ton. On the other hand, the merchant clay sold for an average of $2.30 a ton. Some of the specialties, such as drilling mud, vary from as low as $2 to over $10 a ton.

Miscellaneous clays, including slip clay and shale, sold or used by producers in the United States, 1944–45, by States

State	Sold by producer [1]		Used by producer [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Alabama	(3)	(3)	(3)	(3)	456,488	$277,063
Arizona			48,805	$31,723	48,805	31,723
Arkansas			116,562	76,461	116,562	76,461
California	220,079	$645,058	594,070	358,137	814,149	1,003,195
Colorado	(3)	(3)	(3)	(3)	123,939	74,475
Connecticut			55,480	36,062	55,480	36,062
Georgia	(3)	(3)	(3)	(3)	450,032	300,464
Illinois	(3)	(3)	(3)	(3)	741,882	509,017
Indiana	25,482	13,549	195,714	115,869	221,196	129,418
Iowa	3,705	31,373	482,228	283,747	485,933	315,120
Kansas	(3)	(3)	(3)	(3)	251,240	135,057
Kentucky	(3)	(3)	(3)	(3)	63,520	39,760
Louisiana	(3)	(3)	(3)	(3)	48,491	56,169
Maryland	(3)	(3)	(3)	(3)	172,059	105,758
Massachusetts			58,843	38,248	58,843	38,248
Michigan	(3)	(3)	(3)	(3)	502,114	294,954
Mississippi	(3)	(3)	(3)	(3)	48,872	44,341
Missouri	(3)	(3)	(3)	(3)	233,657	126,506
Montana			16,166	10,508	16,166	10,508
Nebraska	(3)	(3)	(3)	(3)	21,925	16,409
New Jersey	(3)	(3)	(3)	(3)	97,154	65,164
New York	(3)	(3)	(3)	(3)	254,588	176,541
North Carolina			349,659	222,828	349,659	222,828
Ohio	(3)	(3)	(3)	(3)	743,764	462,194
Oklahoma	(3)	(3)	(3)	(3)	174,253	100,010
Oregon			66,787	38,294	66,787	38,294
Pennsylvania	(3)	(3)	(3)	(3)	784,042	503,143
South Carolina			204,703	159,608	204,703	159,608
South Dakota			42,633	22,112	42,633	22,112
Tennessee	(3)	(3)	(3)	(3)	290,768	189,772
Texas	(3)	(3)	(3)	(3)	498,022	587,759
Utah			44,621	46,616	44,621	46,616
Virginia			182,814	107,441	182,814	107,441
Washington			157,012	96,261	157,012	96,261
West Virginia	(3)	(3)	(3)	(3)	70,744	40,134
Wisconsin	(3)	(3)	(3)	(3)	58,714	33,304
Wyoming			6,069	3,945	6,069	3,945
Undistributed [4]	352,708	633,787	5,856,577	3,578,642	123,017	74,435
	601,974	1,323,767	8,478,743	5,226,502	9,080,717	6,550,269
1945						
Alabama	(3)	(3)	(3)	(3)	639,668	469,547
Arizona			59,715	44,786	59,715	44,786
Arkansas			191,827	153,921	191,827	153,921
California	220,059	779,582	696,638	449,316	916,697	1,228,898
Colorado	(3)	(3)	(3)	(3)	78,650	67,302
Connecticut			63,825	47,597	63,825	47,597
Georgia			554,276	423,794	554,276	423,794
Illinois	(3)	(3)	(3)	(3)	1,124,635	957,728
Indiana	36,691	27,598	260,643	206,929	297,334	234,527
Iowa	3,659	37,960	451,527	363,910	455,186	401,870
Kansas			254,764	196,950	254,764	196,950
Kentucky	(3)	(3)	(3)	(3)	68,815	70,189
Louisiana	(3)	(3)	(3)	(3)	66,891	69,357
Maryland	(3)	(3)	(3)	(3)	154,801	132,382
Massachusetts	(3)	(3)	(3)	(3)	48,409	37,104
Michigan	(3)	(3)	(3)	(3)	585,778	450,417
Mississippi	(3)	(3)	(3)	(3)	55,837	59,578
Missouri	(3)	(3)	(3)	(3)	265,265	174,805
Montana			23,778	23,778	23,778	23,778
Nebraska	(3)	(3)	(3)	(3)	35,515	33,857
New Jersey	(3)	(3)	(3)	(3)	111,751	109,980
New Mexico	(3)	(3)	(3)	(3)	18,438	19,048
New York	(3)	(3)	(3)	(3)	320,683	272,302
North Carolina			503,279	472,147	503,279	472,147
Ohio	(3)	(3)	(3)	(3)	772,694	620,151
Oklahoma			243,358	178,658	243,358	178,658
Oregon	(3)	(3)	(3)	(3)	125,462	87,571
Pennsylvania	40,807	35,186	777,935	829,209	818,742	864,395
South Carolina			220,734	184,920	220,734	184,920
Tennessee	(3)	(3)	(3)	(3)	377,798	334,943
Texas	90,511	337,207	623,820	498,503	714,331	835,710
Utah			44,868	55,924	44,868	55,924

See footnotes at end of table.

Miscellaneous clays, including slip clay and shale, sold or used by producers in the United States, 1944–45, by States—Continued

State	Sold by producer [1]		Used by producer [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1945—Continued						
Virginia			193,783	$137,297	193,783	$137,297
Washington	(3)	(3)	(3)	(3)	119,197	91,371
West Virginia	(3)	(3)	(3)	(3)	80,060	65,283
Wisconsin	(3)	(3)	(3)	(3)	61,071	46,734
Undistributed [5]	305,146	$389,436	4,987,043	3,900,246	180,771	120,033
	696,873	1,606,969	10,151,813	8,167,885	10,848,686	9,774,854

[1] Includes following—1944: Slip clay from Michigan and New York, 2,831 tons, $25,322; 1945: 2,958 tons: $32,859. Purchases of common clay and shale by cement companies—1944: 259,218 tons, $129,606; 1945 348,073 tons, $261,055.
[2] Includes following—1944: Common clay and shale used by producer in cement manufacture, 2,563,663 tons, $1,281,830 (estimated); 1945: 2,796,474 tons, $1,398,240 (estimated).
[3] Included under "Undistributed."
[4] Figures include States indicated by (3) and Delaware, District of Columbia, Florida, Idaho, Maine, Minnesota, New Mexico, North Dakota, Puerto Rico, and Vermont.
[5] Figures include States indicated by (3) and District of Columbia, Florida, Idaho, Maine, Minnesota, North Dakota, Puerto Rico, South Dakota, Vermont, and Wyoming.

CLAY PRODUCTS

Although in a few areas, where war construction was active, producers of heavy-clay products had a good market, the industry as a whole declined steadily during the war. Construction was restricted by the War Production Board, labor was scarce, wages and other costs increased, and price adjustments were hard to obtain. Many plants were closed for the duration.

With the end of hostilities, however, the outlook changed. During past years house construction had fallen far short of the needs of the country. This demand, backed by wartime savings and easy credit, was expected to assist the reconversion to a peacetime economy, so construction was encouraged by Government agencies. Consequently the need for clay products mushroomed, and the industry revived as rapidly as it could reopen plants and obtain labor to expand production.

Under Amendment 9 to Order 1 of MPR 592 the OPA approved a general price increase of about 10 percent for brick and tile produced in OPA regions 1 to 12 to assist the industry to obtain labor and increase production.

In the past, heavy-clay-products manufacture has included much hand labor, and the industry has been criticized for not adopting new methods more rapidly. However, the industry has been handicapped financially, and purchase of radically new equipment was difficult. Even so, considerable progress has been made. Power shovels, scoops, and planers have mechanized the pit. Machinery handles the various raw-material processing operations, including the forming of the simpler or more common shapes. But the drying, burning, storing, and shipping operations have used a great deal of hand labor. The scarcity and increasing cost of labor during the past few years have stimulated installation of labor-saving equipment. More and more tunnel kilns are being built to replace other types. Coupling the drier to the tunnel kiln reduces heat losses and rehandling costs still further. Various types of trucks and cranes pick up, carry, and place heavy loads, using pallets or clamps to hold the brick. Belt conveyors are used to advantage in handling both raw materials and brick. Numerous articles describing novel devices and recommended practice have appeared in trade publications.[2]

For example, portable hoppers holding 1,600 pounds of coal, filled daily and placed by a lift truck to feed stokers, will reduce the firing crew substantially.[3]

One factor limiting clay-products output may be a shortage of brick masons. There is said to be an accumulated shortage of over 60,000 bricklayers, and there were relatively few apprentices in 1945. This situation is being corrected as young men return from military service, but training of new men will take time even under intensive training programs. In some localities, schools for apprentices and premium wages while learning on the job have begun to reduce the shortage.[4]

The great increase in popularity of concrete block for building construction during the past year gives the clay-products producer some food for thought. It cannot be said that these concrete units have the durability, water resistance, or attractiveness of structural clay products; but they are being improved, and their competition must be considered seriously. Some structural-clay-products plants have installed concrete-block machines and are then able to supply building contractors with either type of product.

The accompanying table shows shipments of the principal structural clay products during the past 3 years.

Quantity and value of shipments of the principal classes of structural clay products in the United States, 1943–45 [1]

	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Unglazed brick............M brick..	2,403,120	$31,971,000	2,004,110	$28,783,000	2,372,477	$39,149,000
Glazed brick....................do....	3,808	133,000	2,333	82,000	3,630	151,000
Unglazed hollow facing tile....do....	96,519	1,956,000	92,401	1,931,000	98,654	2,272,000
Glazed hollow facing tile......do....	58,265	2,057,000	80,668	3,176,000	92,651	3,856,000
Vitrified paving brick..........do....	33,259	948,000	21,889	654,000	22,557	694,000
Unglazed structural tile..short tons..	988,367	6,710,000	800,146	5,709,000	798,445	6,400,000
Vitrified clay sewer pipe........do....	908,214	19,047,000	781,829	17,387,000	776,417	18,332,000

[1] Compiled from information furnished by the Bureau of the Census, U. S. Department of Commerce.

TECHNOLOGIC DEVELOPMENTS

Research is gradually increasing our knowledge of the physical characteristics of clay. A paper outlining a study of the effect of water on the sand-bonding and plastic characteristics of clays was published in 1945. Water is said to be held rigidly on the surface of clay minerals up to a specified thickness. When this is exceeded, plasticity develops on the addition of a relatively small amount of water. Each type of clay seems to have a characteristic ability to

[2] Robson, J. T., Modern Brick-Plant Layouts: Am. Ceram. Soc. Bull., vol. 25, No. 3, Mar. 15, 1946, pp. 94–99.
[3] Brick and Clay Record, vol. 108, No. 2, February 1946, p. 39.
[4] Federal Reserve Bank of Cleveland, Structural Clay Products Industry: Monthly Business Review, vol. 28, No. 3, Mar. 1, 1946, pp. 1–5.

stabilize water, and some require more time than others to reach maximum. More complete understanding of these relationships may lead to better choice and handling of clays for specific uses.[5]

The Research Committee of the Whitewares Division of the American Ceramic Society has initiated an investigation of ball clays. The objective is to increase "knowledge and insight into the reasons for the characteristic nature of clays." The project is cooperative in nature, in that test work is done in many widely distributed laboratories and supervised by a committee representative of all phases of the industry. A symposium containing detailed description and analysis of test methods, as well as a discussion of objectives and line of procedure, was published by the American Ceramic Society in April 1945. This type of collective research promises to reveal fundamental information that can be of real value in the technology of other clays, as well as ball clay.[6]

During the war clay received its first serious consideration as an ore of aluminum. Many processes were developed and tested through the pilot plant, and two reached the commercial-plant stage. However, as enemy interference with our transportation of bauxite from Guiana declined, the immediate need for domestic ore was reduced. At the end of the war support for alumina-from-clay projects became weaker. The operating companies felt that the plants were not yet ready to compete commercially without Government subsidy. Operation continued through 1945, but at the end of the year the future program was uncertain.

In the vicinity of Munich, in the American zone, Germany has a highly developed bleaching-clay industry. The natural bleaching clays found in Germany are of relatively low quality, but it was found that the bentonite clays in the Munich area could be acid-activated. Between the wars, this industry developed a great variety of high-quality products and distributed them to a world-wide market. As the specifications, production methods, and uses of these materials are of interest to American industry the Field Information Agency, Technical, of the War Department, investigated these plants, and a report will be published sometime in 1946.

[5] Grim, R. E., and Cuthbert, F. L., Some Clay-Water Properties of Certain Clay Minerals: Am. Ceram. Soc. Jour., vol. 28, No. 3, Mar. 1, 1945, pp. 90-95.

[6] Russell, R., Ball Clay Investigation: Am. Ceram. Soc. Ceram. Abs. and Bull., vol. 24, No. 4, Apr. 15, 1945, pp. 122-138.

ABRASIVE MATERIALS

By Robert W. Metcalf and A. B. Holleman

SUMMARY OUTLINE

GENERAL CONDITIONS

Diatomite, pumice and pumicite, and metallic abrasives production rose to new records in 1945. The output of natural abrasives in 1945 totaled 980,780 short tons valued at $9,801,988, an increase of 3 percent in tonnage and 2 percent in value compared with 1944. Artificial abrasives, however, declined 10 percent in tonnage and 12 percent in value compared with 1944, owing principally to the 21-percent drop in output of aluminum oxide. Domestic production of natural abrasives in 1945 constituted 74 and 31 percent, respectively, of the total tonnage and value of artificial and natural abrasives combined, compared with 71 and 28 percent in 1944. Marketed production of emery in 1945 was the highest since 1918, and that of garnet was the highest since 1928. Output of grindstones, pulpstones (for which figures cannot be shown), and grinding pebbles also were larger in 1945 than in 1944. Domestic production of most of the other natural and artificial abrasive products herein discussed, for which data may be shown, registered only moderate declines in 1945 compared with 1944.

The total value of imports of natural abrasive materials in 1945 dropped 43 percent, to $13,493,381. Imports of bort (glaziers' and engravers' diamonds, unset, and miners') accounted for most of this decrease with a 15-percent decline in quantity and a 44-percent decline in value. The lowered receipts probably were due largely to the change in industrial activity because of the close of the war and partly to the more general consumption of smaller, less perfect stones for many industrial purposes. Imports of corundum ore in 1945 continued large and were only 2 percent below the very active year 1944. No imports of crude or prepared pumice were reported in

1945, and only small amounts of garnet, burrstones, grindstones, sharpening stones and tripoli, rottenstone, or diatomite. "Flint, flints, and flintstones" were at more than twice the 1944 level, although much below prewar imports. Natural abrasive materials exported in 1945 were valued at $2,087,598, compared with $2,091,675 in 1944. The value of emery and corundum wheels declined sharply to $144,589, although that of grindstones increased over 60 percent, and that of all other natural abrasive exports showed a moderate gain.

Salient statistics of the abrasives industries in the United States, 1944–45

	1944		1945		Percent of change in 1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Natural abrasives:						
Domestic production (sold or used by producers):						
Diatomite	[1] 174,957	[1] $3,298,178	[1] 174,957	[1] $3,298,178		
Tripoli	18,425	301,863	18,247	306,829	−1.0	+1.6
Quartz	82,379	286,478	57,764	236,803	−29.9	−17.3
Ground sand and sandstone	558,606	3,989,981	533,656	3,709,597	−4.5	−7.0
Grindstones	9,373	356,106	10,033	399,565	+7.0	+12.2
Pulpstones	(2)	(2)	(2)	(2)	(2)	(2)
Oilstones and related products	(3)	(3)	(3)	(3)	(3)	(3)
Millstones	(4)	9,700	(4)	15,018	(4)	+54.8
Tube mill liners	2,063	38,833	1,982	45,933	−3.9	+18.3
Grinding pebbles	8,012	172,418	8,615	201,806	+7.5	+17.0
Pumice and pumicite	88,757	704,110	157,011	1,051,037	+76.9	+49.3
Garnet	(2)	(2)	6,306	375,198	(2)	(2)
Corundum	(3)	(3)			−100.0	−100.0
Emery	6,940	64,858	7,856	75,977	+13.2	+17.1
Total natural abrasives [3]	954,505	9,575,038	980,780	9,801,988	+2.8	+2.4
Artificial abrasives:						
Silicon carbide—production [5]	56,291	4,717,675	53,773	4,238,655	−4.5	−10.2
Aluminum oxide—production [5]	185,573	11,668,838	147,016	9,130,093	−20.8	−21.8
Metallic abrasives (steel shot and grit)—shipments	144,540	8,441,505	146,771	8,524,073	+1.5	+1.0
Total artificial abrasives	386,404	24,828,018	347,560	21,892,821	−10.1	−11.8
Total abrasives	1,340,909	34,403,056	1,328,340	31,694,809	−.9	−7.9
Foreign trade:						
Imports	(6)	23,533,638	(6)	13,493,381	(6)	−42.7
Exports	(6)	2,091,675	(6)	2,087,598	(6)	−.2

[1] Average annual figure for 1942–44. Bureau of Mines not at liberty to publish 1945 data.
[2] Data included in total, Bureau of Mines not at liberty to publish figures.
[3] Data for oilstones and related products in 1944 and 1945 and corundum in 1944 not included in totals; Bureau of Mines not at liberty to publish figures.
[4] Tonnage of millstones not recorded.
[5] Includes Canadian production.
[6] Weight cannot be reported because of varying units.

This chapter includes data for most of the materials used chiefly as abrasives, although certain clays, oxides, and substances mentioned later under Miscellaneous Mineral Abrasive Materials are not included in the statistics presented herein. On the other hand, certain of the abrasive materials for which figures are shown also have important nonabrasive uses.

In the mechanical finishing of aluminum articles, the finer abrasives and reduced wheel speeds are essential to obtain the most attractive finish.[1] Recommendations are made for the proper abrasives and wheels used in roughing, greasing or oiling, buffing, and coloring aluminum products. Tripoli, soft silica, emery flour, and lime are

[1] Aluminum Company of Canada, Ltd., Aluminum Surface Finishes: Montreal, Canada, 1945, 75 pp.

among the abrasive materials employed. The ingredients and composition of abrasive cleaners and their behavior and efficiency for various purposes were outlined by Lesser.[2] Definitions, specifications and description of coated abrasive products such as silicon carbide, aluminum oxide, flint, emery and garnet paper, and belts of various types, and their application to specific industrial operations were published in 1945.[3]

An evaluation of the hardness and other properties of sintered carbides and nitrides indicates that with constant binder volume and grain size the hardness of a sintered alloy depends solely on chemical and physical properties of the materials used.[4] Tests were made of various methods of measuring the hardness of abrasive particles,[5] such as by sand-blast, ball penetration, needle penetration, impact, torsion, and rolling. The sand-blasting, rolling, and impact methods were claimed to be of the greatest practical significance. An Australian handbook recently published by McPhersons, Ltd., Melbourne, contains valuable information on the types and uses of industrial abrasives and operating data and methods of various kinds of grinding equipment.[6]

A treatment has been devised that coats individual abrasive grains with a shell of isotropic vitrescent carbon which, under pressure and heat of grinding, changes to an extremely hard substance claimed to have a cutting power similar to that of diamonds.[7]

NATURAL SILICA ABRASIVES

Diatomite.—The Bureau of Mines has not been at liberty to publish annual production statistics since 1926. Total output (sales) for 3-year periods, however, may be shown. Total sales for the three most recent such periods were as follows: 1936–38, 279,645 short tons valued at $4,377,353; 1939–41, 360,502 tons valued at $5,746,216; and 1942–44, 524,872 tons valued at $9,894,534. The high level of output indicated in the 1942–44 period was exceeded in 1945, although the actual figures cannot be shown.

The principal producing States in 1945, as for many years, were California and Oregon. Increased output was reported in 1945 from Nevada and Washington. No production was made from Florida or Idaho. Other States mining diatomaceous earth in 1945 were Arizona and New York. Statistics of uses of diatomite cannot be shown. It is possible to indicate roughly the relative proportions of shipments for filtration, insulation, and fillers, the principal uses. Filtration accounted for somewhat over half of the total shipments. Fillers took over one-fifth of sales, and insulation about one-eighth. Miscellaneous uses, including small amounts for fine abrasives, comprised the rest.

[2] Lesser, Milton A., Abrasive Cleaners—Scouring Powders, Pastes and Bars: Soap and Sanitary Chemicals, vol. 21, No. 6, June 1945, pp. 44–47.

[3] The Carborundum Co., Sanding and Finishing with Modern Coated Abrasives: Niagara Falls, N. Y., 1945, 88 pp.

[4] Meyer, Oskar, and Eilander, Walter (Theoretical Aspects of the Hardness of Hard Substances): Arch. Eisenhuttenw., vol. 11, 1938, pp. 558–562; trans. in Ind. Diamond Rev., vol. 5, No. 52, March 1945, pp. 58–61; Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 6, June 15, 1945, p. 103.

[5] G. Pahlitzsch, (Comparison of Hardness Tests for Abrasive Materials): Schleif-u. Poliertech., vol. 20, 1943, pp. 41–53; Chem. Zentralb., 1943, II, pp. 2090–2091; Chem. Abs., vol. 30, No. 13, July 10, 1945, p. 2853.

[6] Chemical Engineering and Mining Review, vol. 38, No. 446, Nov. 10, 1945, p. 63.

[7] American Machinist, Bu-X-ite Treatment for Abrasives Abrades with Diamond Efficiency: Vol. 89, No. 18, Aug. 30, 1945, p. 141.

Quotations on diatomite at the beginning of 1945 were reported in E&MJ Metal and Mineral Markets as follows (prices are per ton on an f. o. b. mill, Nevada, basis): Crude, in bulk, dried, $7, nominal; 98- to 100-mesh, $20; low-temperature insulation, $19; high-temperature insulation, $30; fine abrasive, 2 cents per pound. (Bags extra.) These quotations were changed in February to the following: Crude, in bulk, dried, $10 per ton; 98- to 100-mesh, $25; low-temperature insulation, $25; high-temperature insulation, $40; fine abrasive, 2 to 3 cents per pound. (Bags extra.) In March, filtration grades of California diatomite were quoted by the same journal at $20 to $50 per ton, f. o. b. mill. No other changes were reported during the year.

The Great Lakes Carbon Corp., 333 N. Michigan Ave., Chicago, Ill., on December 1, 1944, acquired the assets and properties of the Dicalite Co., at Walteria, Calif., and Terrebonne, Oreg. This company, trading as the Great Lakes Carbon Corp., Dicalite Division, 756 S. Broadway, Los Angeles, Calif., also took over, on April 1, 1945, the U. S. Diatom property near Basalt, Nev., which had been operated for part of 1944 by the Consolidated Feldspar Corp., Trenton, N. J. Later in 1945 the Dicalite Division acquired the properties of the Kittitas Diatomite Co., Ellensburg, Wash., with plant at Kittitas, thus giving that firm producing facilities in four States. According to trade-journal reports, expansion programs were projected for each of these operations. The American Diatomite Corp., Clermont, Fla., and the Fowler-Reeves Corp., Mina, Nev., have ceased operations. Certain companies reported no or curtailed output on account of scarcity of labor and difficulty of obtaining supplies.

Fresh-water deposits of diatomite in the High Plains region of West Texas in Armstrong, Crosby, and other counties were investigated by Evans.[8] Diatomaceous earth was shipped during 1945 from a large deposit in Digby County, Nova Scotia, Canada; other occurrences in this area are being investigated.[9] Diatomite has been produced in Tarapaca Province in Chile for many years. Large deposits also are said to exist near Mejillones and in Antofagasta Province.[10] Brazil's diatomite industry is claimed to be large and well-developed. This mineral in Brazil largely has been used for building purposes, particularly the manufacture of lightweight roofing tiles, and also as a filtering medium in the refining of sugar.[11] Kenya, in Africa, possesses a small diatomite industry, which markets cleaning powder and metal polishes.[12] An occurrence of diatomite near Carew Peak, New Zealand, was investigated.[13] The revival of the Scottish diatomite industry in the Isle of Skye has been the subject of much discussion. The diatomite there is of a moderately good grade, regarded as especially suited for insulation or possibly as a filler in plastics. Modernization of recovery methods is being contemplated in the revival of this dormant industry.[14]

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[8] Evans, Glen L., Diatomite in the High Plains Region of Texas: Univ. of Texas, Bureau of Econ. Geol., Min. Resource Circ. 32, Austin, Tex., 1944, 5 pp.

[9] Messervey, J. P., The Mineral Industry of Nova Scotia: Canadian Min. and Met. Bull. 400, August 1945, p. 397.

[10] Engineering and Mining Journal, vol. 145, No. 10, October 1944, p. 112.

[11] Mining Journal (London), Diatomite in Brazil: Vol. 225, No. 5738, Aug. 11, 1945, p. 518.

[12] Chemical Age, vol. 52, No. 1343, Mar. 24, 1945, p. 271.

[13] Willett, R. W., Diatomaceous Earth, Wainu, Akaroa, New Zealand: New Zealand Jour. Sci. Tech., vol. 25B, No. 2, 1943, p. 90; abstract in Trans. British Ceram. Soc., vol. 43, No. 11, 1944, p. 151A; Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 6, June 15, 1945, p. 113.

[14] Chemical Age, Scottish Diatomite: Vol. 52, No. 1352, May 26, 1945, p. 456; Diatomite in Scotland: Vol. 53, No. 1358, July 7, 1945, p. 10.

Occurrence, production, and importance of kieselguhr or diatomaceous earth in Finland's national economy were detailed by Molder.[15] Uses listed include the manufacture of water glass, glazes, enamels, and ultramarine, cement, light brick, and paving materials. It was also used as filtering agent, catalyzer, as a filler in paper, rubber, and paint, and as a heat-insulator.

The mechanics and advantages of the cooling and filtration of wort were discussed by Dietz.[16] Experiments on the use of diatomite as a filler for newsprint resulted in improved stock, according to Hoffner and Kobe.[17] The activation of diatomite was covered by a Russian patent.[18] A practical study of insulating materials in the petroleum industry by Searle [19] included considerable excellent material on the favorable and unfavorable factors when using diatomite either alone or mixed with clay as an insulating medium in stills and cracking furnaces.

Tripoli.—Production of tripoli, amorphous silica, and rottenstone in 1945 totaled 18,247 short tons valued at $306,829, or 1 percent less in quantity and 2 percent more in value than in 1944. Output in Illinois, which was valued at $184,189 and totaled 11,144 short tons, was 7 percent less than in 1944. Other States marketing these materials in 1945 were Missouri and Pennsylvania.

The principal uses of tripoli are as abrasives—chiefly as a constituent of polishing and buffing compounds—and as filler. Tonnages reported as sold for abrasive use were about one-sixth less in 1945 than in 1944, and the quantity reported sold for fillers increased 16 percent. Tripoli sold for "other uses," including foundry facings, more than doubled. A brief discussion of the mining, preparation, and marketing of tripoli is in process of publication and probably will be released by the Bureau of Mines about the middle of 1946. A description of the plant and products of the Barnsdall Tripoli Co., Seneca, Mo., was published in the early part of 1946.[20]

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1941–45

Year	Illinois		Other States [1]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	13,833	$200,700	15,468	$221,046	29,301	$421,746
1942	12,575	203,390	4,961	69,038	17,536	272,428
1943	10,203	168,758	4,709	75,607	14,912	244,365
1944	12,031	205,732	6,394	96,131	18,425	301,863
1945	11,144	184,189	7,103	122,640	18,247	306,829

[1] 1941: Arkansas, California, Missouri, Oklahoma, Pennsylvania, and Texas; 1942 and 1944: Arkansas, Missouri, and Pennsylvania; 1943: Arkansas, Missouri, Oklahoma, and Pennsylvania; 1945: Missouri and Pennsylvania.

[15] Molder, Karl (Importance of Diatoms in Industry and National Economy): Suomen Kemistilehti, vol. 16, 1943, pp. 38–40; abstract in Chem. Zentralb., vol. 11 (4), 1943, p. 357; Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 6, June 15, 1945, p. 113.

[16] Dietz, Carl, Wort Filtration with Diatomaceous Silica Filter Aids: Brewer's Jour. (Chicago), vol. 92, No. 5, 1945, pp. 22–23, 52; Chem. Abs., vol. 39, No. 15, Aug. 10, 1945, p. 3391.

[17] Hoffner, L. C., and Kobe, Kenneth A., Diatomaceous Earth as a Filler in Newsprint: Pacific Pulp and Paper Ind., vol. 19, No. 1, 1945, pp. 49–52; Chem. Abs., vol. 39, No. 9, May 10, 1945, p. 1987.

[18] Gordienk, V. F., Activation of Kieselguhr: Russian Patent 59,337, Mar. 31, 1941; Chem. Abs., vol. 39, No. 5, Mar. 10, 1945, p. 1028.

[19] Searle, Alfred B., Low Temperature Insulating Materials in the Petroleum Industry: Refractories Jour., vol. 21, No. 5, May 1945, pp. 192–193.

[20] Trauffer, Walter E., Barnsdall's Modern Plant Processes Tripoli, One of Oldest Nonmetals: Pit and Quarry, vol. 38, No. 10, April 1946, pp. 66–68.

Tripoli (including Pennsylvania rottenstone) sold or used by producers in the United States, 1943–45, by uses

Use	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasives	6,146	$101,248	13,218	$210,592	11,113	$188,262
Concrete admixture	335	4,690	316	4,552	1	18
Filler	6,894	114,929	3,423	66,147	3,969	65,569
Oil-well drilling			(1)	(1)		
Other uses [2]	1,537	23,498	1,468	20,572	3,164	52,980
	14,912	244,365	18,425	301,863	18,247	306,829

[1] Included under "Other uses."
[2] 1943: Filter block, foundry facing, and unspecified; 1944: Foundry facing, drilling mud, and unspecified; 1945: Foundry facing and unspecified.

As reported in E&MJ Metal and Mineral Markets, quotations on tripoli in 1945 remained unchanged compared with 1944 and other recent years. Prices are per short ton, f. o. b. Missouri, in paper-lined burlap bags, minimum carlot 30 tons: Once ground, through 40-mesh, rose- or cream-colored, $14.50; double-ground, through 110-mesh, rose or cream, $16; air-floated, through 200-mesh, $26. Quotations on rottenstone in 1945, as given in Oil, Paint and Drug Reporter, were the same as in 1944: Carlots, in bags, at mines, $25.50 per short ton; less than carlots, $37.50 per ton.

Firms actively producing tripoli, amorphous silica, and rottenstone in 1945 were: Illinois (amorphous silica)—Tamms Silica Co., 228 N. LaSalle St., Chicago, Ill., with plant at Olive Branch, and Ozark Minerals Co., Cairo; Oklahoma (mine) and Missouri (mill)—Barnsdall Tripoli Corp., Seneca, Mo.; and Pennsylvania (rottenstone)—Penn Paint & Filler Co., Antes Fort, and Keystone Filler & Mfg. Co., Muncy.

Quartz.—Sales of crude, crushed, and ground quartz from pegmatite veins or dikes and from quartzite in 1945 dropped 30 percent in quantity and 17 percent in value compared with 1944. Crude quartz sold in 1945 rose 60 percent compared with 1944, to 24,392 short tons, the highest figure since 1920. Sales of crushed quartz in 1945 were about half those in 1944. Ground material also showed a substantial decline. The average value per ton of all quartz sold in 1945, however, increased to $4.10, compared with $3.48 in 1944 and 1943.

Quartz (crude, crushed, and ground)[1] *sold or used by producers in the United States, 1941–45*

Year	Crude		Crushed		Ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	8,977	$39,247	24,101	$94,913	8,607	$94,427	41,685	$228,587
1942	2,043	7,937	45,747	144,808	18,088	178,749	65,878	331,494
1943	6,134	55,600	84,233	183,507	9,078	107,451	99,445	346,558
1944	15,222	35,279	61,823	170,325	5,334	80,874	82,379	286,478
1945	24,392	72,392	28,718	93,631	4,654	70,780	57,764	236,803

[1] To avoid duplication, the ground material shown here is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.

Sales of quartz in 1945 were reported from 12 States, one more than reported in 1944. The greater part of the output came from Western States, and the decrease in output was due largely to the smaller production of ferrosilicon in Pacific Coast States as a result of the cessation of hostilities. South Dakota and Massachusetts were listed as producers in 1945, but no output was reported from Tennessee.

Quotations on ground "hard quartz" silica, as given in Oil, Paint and Drug Reporter, remained unchanged throughout 1945 at the following levels: 325-mesh (99½-percent grade), carlots in bags, $15.50 per ton, and less than carlots, $18.50; 140-mesh (99½-percent grade), carlots in bags, $11 per ton, and less than carlots, $16.

Quartz (crude, crushed, and ground) [1] *sold or used by producers in the United States, 1943–45, by States*

State	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	(2)	(2)				
California	(2)	(2)			36,044	$99,113
Washington	(2)	(2)	67,109	$206,477		
Oregon	---	---			1,462	16,260
Maine	140	$840	88	203	4	10
Maryland	827	12,737	(2)	(2)	(2)	(2)
Massachusetts	1,037	7,259	---	---	696	6,349
North Carolina			(2)	(2)	(2)	(2)
Tennessee	8,684	84,530	(2)	(2)	---	---
Virginia			75	303	(2)	(2)
Other States [3]	88,757	241,192	15,107	79,495	19,558	115,071
	99,445	346,558	82,379	286,478	57,764	236,803

[1] To avoid duplication, the ground material included is only that ground by the original producers of the crude quartz or by grinders who purchase from small miners not reporting their production.
[2] Included under "Other States."
[3] 1943: Arizona, California, New Jersey, Washington, and Wisconsin; 1944: Maryland, New Jersey, North Carolina, Tennessee, and Wisconsin; 1945: Maryland, New Jersey, North Carolina, South Dakota, Virginia, and Wisconsin.

Ground sand and sandstone.—Sales of ground sand and sandstone in 1945 continued at a high level but were 4 percent less in tonnage and 7 percent less in value than in 1944. Sales in 1945 were higher than for any years except 1944 and 1943 and totaled 533,656 short tons valued at $3,709,597. Average value per ton in 1945 declined to $6.95, compared with $7.14 in 1944 and $7.27 in 1943. Production by States or groups of States for which comparable data can be presented indicates a large percent of increase in Georgia in 1945, although New Jersey-Pennsylvania had a greater absolute gain in output. Illinois, Massachusetts, Ohio-Virginia-West Virginia, and "Other States" showed moderate decreases in 1945 compared with 1944. The principal States producing sizable tonnages of ground sand and sandstone are Illinois, New Jersey, Ohio, and Pennsylvania.

Ground sand and sandstone sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	487,665	$3,073,730	1944	558,606	$3,989,981
1942	527,886	3,646,643	1945	533,656	3,709,597
1943	541,350	3,937,452			

Ground sand and sandstone sold or used by producers in the United States, 1943–45, by States

State	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona	------	------			20,610	$225,450
California	(1)	(1)	20,872	$208,925		
Washington	3,902	$25,485			(1)	(1)
Georgia	3,252	32,525	3,090	19,823	7,190	27,858
Illinois	164,401	1,180,469	158,673	1,098,275	144,212	1,003,273
Massachusetts	3,148	16,050	2,500	12,000	2,350	11,600
New Jersey and Pennsylvania	179,634	1,119,640	173,551	1,139,818	181,076	1,084,284
Ohio, Virginia, and West Virginia	152,142	1,259,977	152,514	1,182,255	142,002	1,102,135
Other States [2]	34,871	303,306	47,406	328,885	36,216	254,997
	541,350	3,937,452	558,606	3,989,981	533,656	3,709,597

[1] Included under "Other States."
[2] 1943: California, Missouri, North Carolina, and Wisconsin; 1944: Louisiana, Missouri, North Carolina, and Wisconsin; 1945: Missouri, Washington, and Wisconsin.

Distribution of sales of ground sand and sandstone by uses, as reported by firms producing 90 percent of the total sales, indicates that over a period of years the chief consumers for these products, in order of total quantity consumed, are the pottery, porcelain, and tile industries, foundries, and manufacturers of cleaning and scouring compounds or other abrasive products. Glass manufacture, enamel, and fillers account for most of the remaining tonnage for which uses are reported.

Ground sand and sandstone sold or used by producers in the United States in 1945, by uses [1]

Use	Short tons	Value	
		Total	Average per ton
Abrasive:			
Cleansing and scouring compound	93,064	$534,156	$5.74
Other	665	4,533	6.82
Enamel	16,783	122,149	7.28
Filler	7,860	105,530	13.43
Foundry	101,823	635,338	6.24
Glass	52,883	313,219	5.92
Pottery, porcelain, and tile	162,232	1,271,998	7.84
Other uses	44,417	333,291	7.50
Total reported by uses	479,727	3,320,214	6.92

[1] Data represent 90 percent of the industry.

Abrasive sands.—Natural sands with a high silica content are employed for sand blasting, stone polishing, glass grinding, coating sandpaper, or other abrasive uses. Sales of such grinding and polishing sand in 1945 totaled 642,511 short tons valued at $1,029,501. Included in these data were 318,390 tons of blast sand valued at $766,013. Information with respect to tonnages produced in each State, where these data may be published, appears in the chapter on Sand and Gravel in this volume. Sales of blast sand and total abrasive sands from 1936 to 1945 are shown in an accompanying table. The figures stress the increasing importance of sand blasting operations in modern industry, and particularly their expanding employment in wartime.

Abrasive sands sold or used by producers in the United States, 1936–45, in short tons

Year	Blast sand			Total abrasive sands		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
1936	(1)	(1)	(1)	934,059	$1,306,871	$1.40
1937	(1)	(1)	(1)	1,067,178	1,440,736	1.35
1938	205,753	$509,178	$2.47	502,328	754,805	1.50
1939	220,240	542,915	2.47	668,027	895,989	1.34
1940	256,104	597,198	2.33	856,309	915,925	1.07
1941	371,049	912,626	2.46	1,001,814	1,388,966	1.39
1942	422,922	1,071,018	2.53	806,878	1,363,168	1.69
1943	450,997	1,138,003	2.52	837,662	1,428,463	1.71
1944	482,293	1,228,744	2.55	897,983	1,563,511	1.74
1945	318,390	766,013	2.41	642,511	1,029,501	1.60

[1] Not separately reported.

SPECIAL SILICA-STONE PRODUCTS

Grindstones and pulpstones.—Production of grindstones in 1945 was 7 percent larger in tonnage and 12 percent greater in value than in 1944 but slightly less in tonnage than in 1943. Sales of pulpstones in 1945 increased substantially compared with 1944, although the Bureau of Mines is not at liberty to publish actual data. As in 1944, grindstones were produced in Ohio and West Virginia and pulpstones in West Virginia only.

Grindstones and pulpstones sold by producers in the United States, 1941–45

Year	Grindstones		Pulpstones		
	Short tons	Value	Quantity		Value
			Pieces	Equivalent short tons	
1941	13,573	$434,208	685	1,963	$111,348
1942	12,763	422,763	528	1,918	116,976
1943	10,732	392,296	323	1,891	95,909
1944	9,373	356,106	(1)	(1)	(1)
1945	10,033	399,565	(1)	(1)	(1)

[1] Bureau of Mines not at liberty to publish figures.

Oilstones and related products.—Sales of natural sharpening stones, including oilstones, whetstones, scythestones, and rubbing stones, were somewhat higher in 1945 than in 1944. The Bureau of Mines, however, has not been at liberty to publish sales data since 1939. Producing States in 1945 and the type of abrasive stone reported from each were: Arkansas—oilstones and whetstones; Indiana—rubbing stones and whetstones; New Hampshire—scythestones; and Ohio—scythestones, whetstones, and "other" sharpening stones, including lathestones.

Millstones.—The value of sales of millstones in 1945 totaled $15,018, 55 percent greater than in 1944 and the highest value since 1941. Marketed production of millstones in 1945 was reported by the following: Jasper Stone Co., Sioux City, Iowa, deposit in Rock County, Minn.; George Coddingham, Accord, N. Y., deposit in Ulster County; Gardner Granite Works, Salisbury, N. C., deposit in Rowan County; Interstate Millstone Co., Christiansburg, Va., deposit in Montgomery County.

Value of millstones and chasers sold by producers in the United States, 1941–45 [1]

Year	Producers	Value	Year	Producers	Value
1941	8	$15,579	1944	3	$9,700
1942	5	10,391	1945	4	15,018
1943	4	9,240			

[1] 1941: New York, North Carolina, Virginia, and West Virginia; 1942–44: New York, North Carolina and Virginia; 1945: Minnesota, New York, North Carolina, and Virginia.

Grinding pebbles and tube-mill liners.—Marketed production of grinding pebbles and tube-mill liners combined rose 5 percent in tonnage and 17 percent in value in 1945 compared with 1944 and totaled 10,597 short tons valued at $247,739. Sales of grinding pebbles in 1945 increased 8 percent in quantity and 17 percent in value compared with 1944. The value of tube-mill liners increased 18 percent, although the tonnage sold showed a small decrease of 4 percent. The Bureau of Mines has not been free to publish totals for grinding pebbles and tube-mill liners from 1933 through 1940. Current production levels, although considerably under 1941 and 1942 figures, nevertheless are generally 2 to 4 times those reported to the Bureau of Mines in most years since 1920. During the last two months of 1945, small shipments of flint pebbles were received from Belgium and Denmark, the first since the end of the war.

Grinding pebbles and tube-mill liners sold or used by producers in the United States, 1941–45

Year	Grinding pebbles		Tube-mill liners		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	13,561	$22,826	3,411	$54,216	16,972	$276,042
1942	15,487	245,794	2,576	49,967	18,063	295,761
1943	9,924	157,778	2,585	46,071	12,509	203,849
1944	8,012	172,418	2,063	38,833	10,075	211,251
1945	8,615	201,806	1,982	45,933	10,597	247,739

Grinding pebbles and tube-mill liners in 1945 were produced in the same States as in 1944—grinding pebbles in California, Minnesota, North Carolina, Texas, Washington, and Wisconsin and tube-mill liners in Minnesota, North Carolina, and Wisconsin.

The following firms in 1945 produced for sale the products indicated: John T. Momand, Carlsbad, Calif., beach pebbles; Jasper Stone Co., Sioux City, Iowa, quartzite liners and artificially rounded quartzite grinding pebbles (quarries at Jasper, Minn.); Southern Products & Silica Co., Lilesville, N. C., silica grinding pebbles; Harris Granite

Quarries Co., Salisbury, N. C., rounded granite cubes and liners; Peeler & McCombs, Faith, N. C., rounded granite cubes and liners; Dezendorf Marble Co., Austin, Tex., flint pebbles; Mineral Products Co., Seattle, Wash., grinding pebbles; and Baraboo Quartzite Co., Baraboo, Wis., quartzite pebbles and granite liners.

Comparative grinding tests on hard and fibrous materials using flint, Jasper adamant, zircon, and porcelain balls were described by Metz.[21] Grinding in connection with flotation separation and auxiliary control equipment were high-lighted.

NATURAL SILICATE ABRASIVES

Pumice and pumicite.—Production of pumice and pumicite (or volcanic ash) broke all records in 1945, and rose to 157,011 short tons valued at $1,051,307, 24 percent larger in tonnage and 49 percent higher in value than 1942, the previous peak year. The quantity marketed in 1945 surpassed that sold in 1944 by 77 percent.

Pumice or pumicite was reported from eight States in 1945, the same States as in 1944, with the addition of a small output from Idaho. California replaced Kansas as the chief producing State and accounted for 48 percent of the total production, compared with 30 percent of the total for Kansas. All States for which comparisons are possible showed substantial increases in 1945 compared with 1944, ranging from 10 and 11 percent, respectively, for Kansas and Nebraska to 140 percent for California and a much larger percent of increase for Washington (464 percent).

Pumice and pumicite sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	117,310	$669,514	1944	88,757	$704,110
1942	126,522	706,199	1945	157,011	1,051,037
1943	85,150	611,495			

Pumice and pumicite sold or used by producers in the United States, 1943–45, by States

State	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
California	25,490	$160,441	31,409	$245,898	75,238	$481,664
Idaho					(1)	(1)
Kansas	43,918	163,366	43,034	163,538	47,484	187,651
Nebraska	(1)	(1)	6,083	51,043	6,764	59,735
New Mexico	4,837	202,558	(1)	(1)	(1)	(1)
Oklahoma	(1)	(1)				
Oregon			(1)	(1)	(1)	(1)
Texas	(1)	(1)	(1)	(1)	584	11,680
Washington	700	7,362	783	8,705	4,414	36,045
Undistributed [2]	10,205	77,768	7,448	234,926	22,527	274,262
	85,150	611,495	88,757	704,110	157,011	1,051,037

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

[21] Metz, G. F., Recent Developments in Grinding Ceramic Materials in Pebble, Ball, and Tube Mills (abs.): Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 10, Oct. 15, 1945, p. 357.

Pumice and pumicite sold for concrete admixture and concrete aggregate in 1945 totaled 72,901 short tons, slightly more than the total reported used for all abrasive purposes—71,011 tons—but very much less in value. The increase in output for acoustic plaster and for concrete aggregate and mixtures resulted from the greater use of pumice or pumicite-containing lightweight block and tile in construction, especially in California and Washington. Cleaning and scouring compounds, hand soaps, and other abrasives rose 11 percent in quantity in 1945 compared with 1944 and accounted for 45 percent of the total tonnage marketed. Quantities sold for "other uses" also increased sharply and in 1945 included sales for use in insecticides, insulation, plastics, and solvents.

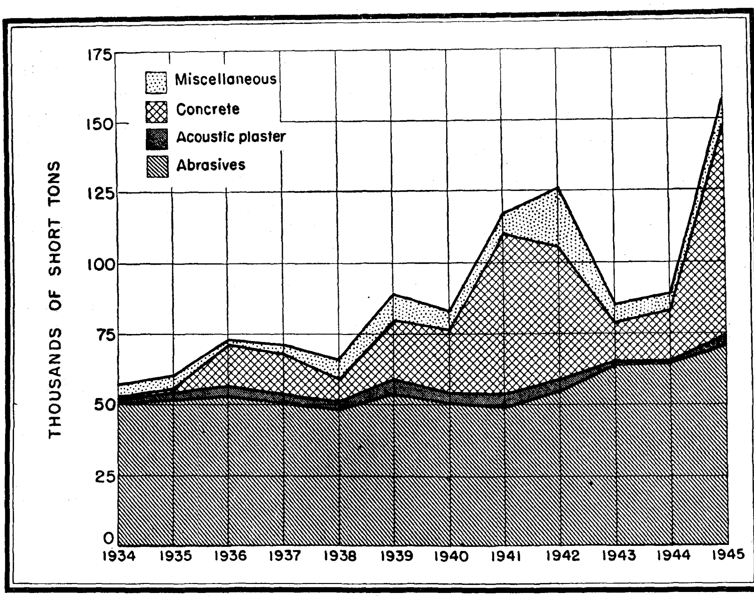

FIGURE 1.—Trends, by uses, of pumice and pumicite sold or used by producers in the United States, 1934–45.

Pumice and pumicite sold or used by producers in the United States, 1943–45, by uses

Use	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
Abrasive:						
Cleansing and scouring compounds and hand soaps	59, 247	$354, 242	57, 833	$375, 310	63, 704	$434, 928
Other abrasive uses	4, 216	64, 988	6, 094	136, 753	7, 307	229, 212
Acoustic plaster	1, 617	29, 860	938	29, 144	3, 693	78, 278
Concrete admixture and concrete aggregate	13, 794	52, 718	17, 511	90, 136	72, 901	176, 920
Other uses [1]	6, 276	109, 687	6, 381	72, 767	9, 406	131, 699
	85, 150	611, 495	88, 757	704, 110	157, 011	1, 051, 037

[1] 1943: Asphalt, insecticide, paint filler, brick manufacture, filtration, solvents, and unspecified; 1944: Insecticide, insulation, brick manufacture, filtration, solvents, and unspecified; 1945: Insecticide, insulation, solvents, plastics, and unspecified.

Quotations on pumice in 1945, as reported by E&MJ Metal and Mineral Markets, remained unchanged from 1944 figures and were as follows: F. o. b. New York or Chicago, in barrels—lump, 5 @ 7½ cents per lb., and powdered, 2½ @ 4½ cents per lb.

Garnet.—Output of garnet in 1945 rose to 6,306 short tons valued at $375,198, the highest tonnage since 1928 and 6 percent greater than in 1943. The trend in garnet production in the last quarter century is shown in figure 2. Producers in 1945 were the following: Barton Mines Corp., North Creek, N. Y.; Estate of John Burnham, Essex, N. Y.; Garnet Mines, Inc., 725 Paulson Bldg., Spokane, Wash.; and Spokane Garnet Sand & Sales Co., P. O. Box 1452, Spokane, Wash., and its successor, Idaho Garnet Abrasive Co., of the same address. The last three firms all recovered garnet sand from stream beds in western Idaho. A description of the Gore Mountain garnet quarry, operated by Barton Mines Corp., North Creek, N. Y., appeared in 1945.[22] Trade reports indicate possible production in California.[23]

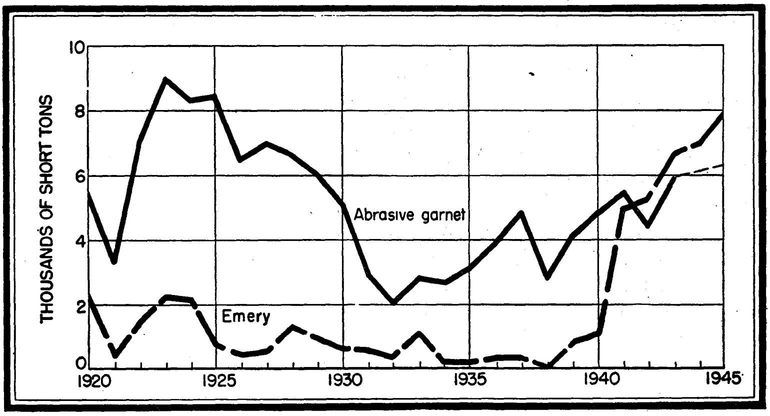

FIGURE 2.—Marketed production in the United States of abrasive garnet and domestic emery, 1920–45.

Quotations on domestic garnet in 1945 as reported by E&MJ Metal and Mineral Markets were the same as in 1944 and immediately preceding years: New York Adirondack garnet concentrates, grain—$85 per short ton.

Abrasive garnet sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	5,501	$371,752	1944	(1)	(1)
1942	4,357	299,904	1945	6,306	$375,198
1943	5,935	429,120			

1 Bureau of Mines not at liberty to publish figures.

22 Lisle, T. Orchard, Red Garnets by the Ton—a Remarkable Quarry near Lake George, N. Y.: Rocks and Minerals, vol. 20, No. 19, October 1945, p. 471.

23 Engineering and Mining Journal, vol. 146, No. 7, July 1945, p. 118.

NATURAL ALUMINA ABRASIVES

Corundum.—Corundum, a natural alumina abrasive, Al_2O_3, was especially needed during the war for use in snagging wheels by companies making tanks, guns, and other heavy military equipment and for polishing highly essential precision lenses.

Efforts to establish and foster a domestic corundum industry resulted only in a small, almost negligible output, which was consumed largely for experimental purposes. Tests were undertaken principally in South Carolina, North Carolina, and Montana. Although considerable tunneling and development work was carried forward, particularly in Montana, activity in each of these States finally was discontinued.

Most of the corundum consumed in the United States for many years originated in the Union of South Africa, particularly in the Transvaal. In normal years this source furnished a fairly steady supply despite the handicaps of distance and transportation difficulties. Production in South Africa during the war was stimulated in every way possible by the Foreign Economic Administration and other agencies. Although imports for consumption in the United States rose considerably during the war years, the receipts were hardly adequate to satisfy the stepped-up demand for production of optical equipment and heavy matériel needed by the Army and Navy. The supply of corundum still is somewhat short of demand. Imports in 1945, however, were maintained at a high level throughout the year and were only slightly under the figure reported in 1944, which was the highest year since 1910. Supplementing receipts from the Union of South Africa, shipments from other countries occasionally have been received, including Canadian material recovered from tailings dumps at now long-abandoned mines.

A study of the control activities of the Government in relation to corundum supplies during the war was published.[24] Efforts to establish a grinding-wheel industry based upon Indian corundum were reported by Rao.[25] Locally compounded bonds were used. The test wheels were said to be satisfactory except for the uneven surface wear due to hand molding.

Quotations on crude corundum imported into the United States are not given in domestic trade journals. Corundum grain throughout 1945 was quoted in E&MJ Metal and Mineral Markets as follows: Per pound, sizes 8 to 60, inclusive, 8¾ cents; 70 to 275, inclusive, 9¾ cents; 500, 30 cents; 850 to 1,000, inclusive, 45 cents; 1,200 to 1,600, inclusive, 60 cents; and 2,600, 70 cents.

Emery.—Sales of domestic emery in 1945 were the largest since 1918, reaching 7,856 short tons valued at $75,977 (see fig. 2), 13 percent higher in tonnage and 17 percent higher in value than in 1944, an active year. The entire output, as in other recent years, was mined in and near Peekskill, N. Y., by Joe DeLuca and DiRubbo & Ellis. Emery is shipped largely as crude rock to manufacturers of grinding wheels, abrasive sticks, polishing compositions, and similar materials. It also is marketed as grain to other makers of abrasive products.

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[24] Parks, Roland D., Corundum—a Vital Wartime Abrasive: Am. Inst. Min. and Met. Eng., Min. Technol., vol. 9, No. 3, May 1945, Tech. Pub. 1883, 8 pp.

[25] Raja Rao, P. S., High-Speed Grinding Wheels from Mysore Corundum: Trans. Indian Ceram. Soc., vol. 3, No. 1, 1944, pp. 42–48; Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 10, Oct. 15, 1945, p. 175.

Considerable amounts are employed as a nonslip, wear-resistant component in concrete floors.

According to E&MJ Metal and Mineral Markets, quotations on crude domestic emery ore remained unchanged in 1945, compared with 1944: $10 per ton for first-grade emery, f. o. b. New York. Grain emery was quoted by the same source as follows (prices are per pound, in 350-lb. kegs, f. o. b. Pennsylvania): Turkish and Naxos, 7 cents; Khasia, 6 cents; and American, 5 cents. The quotation for Indian emery grain (Khasia) was discontinued in July.

Emery sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	4,876	$42,484	1944	6,940	$64,858
1942	5,277	49,413	1945	7,856	75,977
1943	6,666	63,195			

NATURAL CARBON ABRASIVES [26]

Abrasive or industrial diamonds.—Industrial diamonds are produced chiefly in the Belgian Congo, and most of the rest of the world's supply is obtained from Gold Coast, Sierra Leone, and Angola. Total sales of industrials in 1944 were placed at £3,800,000, compared with the record figure of about £5,500,000 in 1943. Sales during the war years have exceeded production by large margins, and the war demands for this product have been met only by very heavy withdrawals from accumulated stocks of the Diamond Trading Co. For the most part, these stocks now have been virtually exhausted, particularly in certain classifications. Certain South African mines have been reopened in order to supply, at least partly, the expected demand. Although postwar industrial activity undoubtedly will be somewhat less than during the war, a steady if smaller market for industrial diamonds will continue. The wider use of diamond grinding wheels, used in finish grinding of carbide tools and of hard metals and alloys and other substances, the expansion and greater standardization of diamond-cutting tools, the growing employment of diamonds in blast-hole drilling, and the use of diamond dies for making the fine wires needed in the expected growth of the electronics industry are all indicative of a continued active demand.

Reflecting the curtailment of military production and the resultant current slackening in volume of industrial production, receipts in 1945 of "bort (glaziers' and engravers' diamonds, unset, and miners')"—roughly corresponding to so-called "industrial grades"—dropped to 10,726,372 carats, the smallest year's imports since 1941, but much exceeding quantities received in 1941 and immediately preceding years.

A comprehensive review of all phases of the diamond industry was published.[27] When the shortage of high-quality stones became acute during the war, intense study was devoted to the possibility of

[26] See also chapter on Gem Stones of this volume.
[27] Ball, Sydney H., The Diamond Industry in 1944: Jewelers' Circular—Keystone, New York, 1945, 24 pp.

using lower-grade material for certain uses. In this connection, Whittaker[28] reported, after exhaustive tests, that the lower-quality stones may be substituted for the better grades heretofore employed in dresser tools, provided the stones are selected with suitable care. Criteria and methods of selecting industrial diamonds for specific uses were described by Grodzinski.[29]

The uses and modern applications of diamond dust in industrial operations were summarized in 1945.[30] Conditions in the diamond-cutting industries of the United States and Puerto Rico were investigated.[31] An account of the development of a diamond-die industry in the United States was published.[32] Descriptions of diamond deposits and discoveries in Brazil,[33] Venezuela,[34] and Russia (U. S. S. R.)[35] were given in the trade press.

A large electrical company has undertaken the manufacture of artificial sapphires for use as bearings in navigation instruments.[36] Grodzinski[37] described the use of sapphire plug and ring gages and other types of sapphire gages and workpieces and their much longer life compared to high-quality steel gages. Differences between natural and artificial sapphires were clearly outlined.[38] The manufacture of artificial sapphires for jewel bearings in Great Britain supplied a wartime demand.[39]

ARTIFICIAL ABRASIVES

Production of artificial abrasives (silicon carbide, aluminum oxide, and metallic abrasives) continued at a higher level in 1945, although, except for steel shot and grit (metallic abrasives), tonnages were somewhat less than in 1944. The total tonnage of these three abrasive materials in 1945 was 347,560 short tons valued at $21,892,821, or 10 percent in quantity and 12 percent in value less than in 1944. Shipments of metallic abrasives (steel shot and grit) in 1945 totaled 146,771 short tons valued at $8,524,073, a new high in both quantity and value. Operation was only at 70 percent of capacity, owing to new plants starting in the industry. Production of silicon carbide in 1945 was 4 percent less in quantity and 10 percent less in value than in 1944. Output of aluminum oxide in 1945 decreased 21 percent in tonnage and 22 percent in value to the lowest point since 1940. Production of silicon carbide and aluminum oxide in 1945 was at 75 per-

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[28] Whittaker, H., Report on Substitution of Lower-Quality Industrial Diamonds in Diamond Dresser Tools: War Production Board, Oct. 16, 1944, 20 pp.

[29] Grodzinski, Paul, Selection of Industrial Diamonds: Min. Jour. (London), vol. 226, No. 5759, Jan. 5, 1946, pp. 5-7.

[30] Industrial Diamond Review, Diamond Dust, A Review of Recent Literature: Vol. 57, No. 5, August 1945, pp. 169-171, 181.

[31] The Jewelers' Circular—Keystone, The Diamond Cutting Industry: Vol. 115, No. 11, August 1945, pp. 186, 234, 236.

[32] Wire and Wire Products, American War Production Board Reports on Diamond Dies: Vol. 20, March 1945, pp. 224-227; also in Ind. Diamond Rev., vol. 5, No. 54, May 1945, pp. 97-98.

[33] South African Mining and Engineering Journal, Brazilian Diamonds: vol. 56, No. 2734, July 7, 1945, p. 453.

[34] Davey, John C., Venezuela—The Guayana Highlands; Diamantiferous Alluvials of the State of Bolivar: Min. Mag. (London), vol. 74, No. 1, January 1946, pp. 9-26.

[35] Mining Journal (London), Russian Diamond Industry in the Urals—New Deposits: vol. 224, No. 5729, June 9, 1945, p. 369.

[36] Chemical and Engineering News, vol. 23, No. 17, Sept. 10, 1945, p. 1572.

[37] Grodzinski, Paul, Sapphire Gauges: Ind. Diamond Rev., vol. 5, No. 61, December 1945, p. 294.

[38] The Jewelers' Circular—Keystone, Sapphire, Birthstone for September: vol. 115, No. 12, September 1945, pp. 186, 234, 236, 238.

[39] South African Mining and Engineering Journal, Making Synthetic Sapphires—Jewelled Bearing Development: Vol. 56, No. 2761, Jan. 12, 1946, p. 507.

cent and 63 percent of capacity, respectively. Fluctuations in stocks and capacity over a 10-year period beginning with 1936 appear in an accompanying table.

Crude artificial abrasives sold, shipped, or used from manufacturing plants in the United States and Canada, 1941–45

Year	Silicon carbide [1]		Aluminum oxide [1]		Metallic abrasives [2]		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	44,962	$3,325,928	147,759	$9,067,732	86,309	$4,050,659	279,030	$16,444,319
1942	61,681	4,904,309	183,633	12,719,337	106,442	5,618,913	351,756	23,242,559
1943	69,706	5,912,590	217,425	13,202,270	124,954	7,083,141	412,085	26,198,001
1944	56,291	4,717,675	185,573	11,668,838	144,540	8,441,505	386,404	24,828,018
1945	53,773	4,238,655	147,016	9,130,093	146,771	8,524,073	347,560	21,892,821

[1] Production; Bureau of Mines not at liberty to publish data for United States separately. Figures include material used for refractories and other nonabrasive purposes.
[2] Figures include only shipments from United States plants.

Production of silicon carbide and aluminum oxide largely is concentrated in the Niagara Falls region of Canada and the United States; some aluminum oxide, however, also is manufactured in Quebec, Canada, and in Alabama. The same companies that produced aluminum oxide and silicon carbide in 1944 and other recent years were active in 1945. The total for aluminum oxide in 1945 included 18,804 short tons of "white high-purity or special material" valued at $2,065,350, a decline of 27 percent in both tonnage and value compared with 1944. Silicon carbide consumed in refractory or nonabrasive uses in 1945 was estimated at 44 percent of the total production, and aluminum oxide consumed for similar purposes in 1945 was estimated at 4 percent.

Stocks of crude artificial abrasives and capacity of manufacturing plants, as reported by producers, 1936–45, in short tons

Year	Silicon carbide		Aluminum oxide		Metallic abrasives	
	Stocks at end of year	Capacity	Stocks at end of year	Capacity	Stocks at end of year	Capacity
1936	6,613	(1)	14,101	(1)	2,198	(1)
1937	6,074	(1)	17,966	(1)	3,012	(1)
1938	12,568	(1)	32,121	(1)	4,944	(1)
1939	7,475	(1)	21,528	(1)	4,389	(1)
1940	3,621	(1)	18,372	(1)	5,042	(1)
1941	2,640	44,960	19,546	150,146	3,708	136,750
1942	4,806	61,681	20,707	179,214	4,278	142,026
1943	9,384	70,938	28,360	222,602	2,524	169,500
1944	8,916	71,850	32,402	234,000	3,388	191,289
1945	4,347	72,000	31,933	233,300	10,433	209,360

[1] Data not available.

Statistics for metallic abrasives cover steel shot and grit (including figures for one firm that manufactures a similar product from salvaged wire clippings) but not steel wool. The principal producing States in 1945, in order of production, were Ohio, Michigan, and Pennsylvania. Other States in which metallic abrasives were manufactured in 1945 were Illinois, Massachusetts, New Hampshire, and New York. Fifteen firms with 16 plants reported shipments in 1945, compared with 13 companies and 14 plants in 1944.

Producers of metallic abrasives in 1945 were the following:

Western Metal Abrasives Co., 2547 East 79th St., Cleveland 4, Ohio—plant at Chicago Heights, Ill.
Holden & Norris, Inc., Eames St., Wilmington, Mass.
Industrial Metal Abrasives Co., 1603 Wildwood Ave., Jackson, Mich.
Erwin Foundry & Mfg. Co., 1018 East Michigan St., Adrian, Mich.
Cleveland Metal Abrasive Co., 887 East 87th St., Cleveland 8, Ohio—plant at Howell, Mich.
Clayton-Sherman Abrasives Co., 3896 Lanyo Road, Detroit 10, Mich.
Harrison Abrasive Corp., 887 Chestnut St., Manchester, N. H.
Abrasive Shot & Grit Co., 1 Carolina St., Springville, N. Y.
American Steel Abrasives Co., Sherman, East & Charles St., Galion, Ohio.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland 8, Ohio—plant at Cleveland.
National Metal Abrasive Co., 3560 Norton Road, Cleveland 11, Ohio.
Steelblast Abrasives Co., 6536–40 Carnegie Ave., Cleveland 3, Ohio.
Cut Steel Abrasives, Inc., P. O. Box 394, 1609 Wilson Ave., Youngstown 1, Ohio.
Globe Steel Abrasive Co., 238 First Ave., Mansfield, Ohio.
Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh 1, Pa.
Philadelphia Steel Abrasive Co., Vandalia & McKean Sts., Philadelphia 48, Pa.

Manufacture of alumina abrasives of modified grain size was described by Bauman and Benner.[40] Alumina is sintered at about 1,800° with small amounts of TiO_2 and either Cr_2O_3 or V_2O_3 to obtain a solid solution of the other oxides in the alumina. Zirconium and vanadium oxides in amounts up to 2 percent reduce grain size, whereas manganese, iron, chromium, and titanium oxides increase it. The making of boron carbide, B_4C, in the electric furnace at temperatures exceeding 5,000° F. was outlined in the technical press.[41] The uses of boron carbide include the lining of compressed-air nozzles used in pressure blasting, because of its extreme resistance to abrasion, and the lapping or polishing of metal parts.[42]

Production of smooth surfaces has been claimed for an abrasive product made by cementing finely divided SiC, B_4C, or diamond dust to granules of quartz, gravel, or Al_2O_3.[43]

MISCELLANEOUS MINERAL ABRASIVE MATERIALS

In addition to the natural and manufactured abrasive materials for which data are included herein, many other mineral substances are used for abrasive purposes. Various oxides, such as tin oxide, rouge, crocus, chromium oxide, magnesium, and manganese oxides, are utilized as polishing agents. Cerium oxide also recently has been

[40] Bauman, Jr., Henry N., and Benner, Raymond C. (assigned to the Carborundum Co.), Modified Alumina Abrasive: United States Patent 2,369,709, Feb. 20, 1945; Chem. Abs., vol. 39, No. 20, Oct. 20, 1945, p. 4736.
[41] Laboratory, New Boron Carbide Mortar is Hardest Ever Produced: Vol. 15, No. 4, 1945, pp. 80–81; Am. Ceram. Soc., Ceram. Abs. and Bull., vol. 24, No. 10, Oct. 15, 1945, p. 185.
[42] Compressed Air Magazine, Only a Diamond is Harder: Vol. 50, No. 7, July 1945, p. 192.
[43] Fruth, Hal F. (assigned to Galvin Mfg. Co.), Abrasive Material: United States Patent 2,378,399, July 19, 1945; Chem. Abs., vol. 39, No. 18, Sept. 20, 1945, p. 4208.

favored especially for glass polishing because of its cleanliness and efficiency. Among manufactured or artificially prepared products used as abrasives are boron carbide and a periclase abrasive derived from magnesite. Another series of abrasive products valuable for their durability and hardness comprise the so-called cemented carbides, including tungsten carbide, tantalum carbide, titanium carbide, etc. Natural materials with specialized abrasive applications include finely pulverized and calcined clays (china clays, ball clays, fire clays), high-grade lime (Vienna and Sheffield lime), talc, ground feldspar, river salt, slate flour, whiting, and other substances.

FOREIGN TRADE [44]

The total value of imports of abrasive materials in 1945 decreased 43 percent compared with 1944, owing almost wholly to the drop in value of bort (glaziers' and engravers' diamonds, unset, and miners'). This classification, comprising largely what are known as industrial grades, dropped 15 percent in quantity (carats) and 44 percent in value, but was much higher than in the years immediately preceding 1941. Imports of corundum ore remained at a high level, almost equaling the tonnage of 1944, the highest since 1910. Imports of garnet, though small in aggregate, increased considerably in 1945 compared with 1944. "Flint, flints, and flint stones, unground," which includes grinding pebbles, were over twice 1944 imports in tonnage and 262 percent greater in value, although much below prewar receipts. No crude or prepared pumice was imported in 1945 and only small quantities of burrstones, grindstones, sharpening stones (hones, oilstones, and whetstones) and tripoli, rottenstone, and diatomaceous earth.

Reflecting not only increased costs in South Africa and strong efforts to stimulate output there but also the continuing demand for industrial uses, the average value (foreign market value) of corundum ore in 1945 rose to $73.12 per short ton, compared with $68.31 in 1944 and $58.60 in 1943. Average value per carat of imports of "industrial diamonds" or bort (unmanufactured) dropped to $1.19, compared with $1.80 in 1944 and 1943, such decrease probably due partly, at least, to the more prevalent use of smaller diamonds for bonded cutting and grinding tools and other abrasive purposes.

The total value of exports of natural abrasive materials in 1945 was $2,087,598, or only slightly less than that reported in 1944. The value of export shipments of emery and corundum abrasive wheels dropped 58 percent, although the value of grindstones exported increased over 60 percent. The classification including all other natural abrasives registered a moderate gain.

[44] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Abrasive materials imported for consumption in the United States, 1943–45, by kinds

Kind	1943		1944		1945	
	Quantity	Value	Quantity	Value	Quantity	Value
Burrstones: Bound up into millstones……short tons	16	$1,204	13	$854	22	$1,406
Grindstones, finished or unfinished short tons	295	11,130	358	14,130	250	8,893
Hones, oilstones, and whetstones short tons	4	20,039	14	18,662	12	11,864
Emery:						
Grains, ground, pulverized, or refined……pounds	(1)	(1)	(1)	(1)	(1)	(1)
Paper and cloth coated with emery or corundum	(2)	76,193	(2)	77,652	(2)	89,333
Wheels, files, and other manufactures of emery or corundum or garnet……pounds	178,198	110,618	50,559	16,642	26,323	5,115
Corundum (see also "Emery"):						
Ore……short tons	5,686	333,209	6,402	437,306	6,244	456,581
Grains, ground, pulverized, or refined……pounds	[1] 245,060	[1] 12,927	[1] 72,347	[1] 5,017	[1] 75,092	[1] 4,553
Garnet in grains, ground, etc…do			400	6	6,100	92
Tripoli, rottenstone, and diatomaceous earth……short tons	6	268	3	60	37	1,170
Pumice:						
Crude or unmanufactured short tons	33	1,155	40	1,398		
Manufactures, n. s. p. f						10
Diamonds:						
Bort, manufactured……carats	1,512	26,376	12	1,266	1,099	28,721
Bort (glaziers' and engravers' diamonds, unset, and miners')……carats	12,073,241	21,738,925	12,603,647	22,658,224	10,726,372	12,756,973
Carbonado and ballas……do	10,892	151,643	10,860	236,020	3,497	53,959
Dust……do	89,785	74,309	42,316	58,811	62,317	47,213
Flint, flints, and flint stones, unground……short tons	484	7,165	651	7,590	1,323	27,498
		22,565,161		23,533,638		13,493,381

[1] Emery included with corundum; not separately classified.
[2] 1,788 reams in 1943; 890 reams in 1944; 718 reams in 1945; weight not recorded.

Value of domestic abrasive materials exported from the United States, 1941–45

Material	1941	1942	1943	1944	1945
Grindstones	$187,621	$224,998	$213,170	$155,048	$252,293
Abrasive wheels, emery and corundum	144,393	3,665,386	1,295,011	342,215	144,589
All other natural abrasives, whetstones, hones, etc	2,887,628	2,793,968	2,002,988	1,594,412	1,690,716
	3,219,642	6,684,352	3,511,169	2,091,675	2,087,598

SULFUR AND PYRITES

By G. W. Josephson and M. G. Downey [1]

SUMMARY OUTLINE

GENERAL SUMMARY

The Axis countries surrendered in 1945, and by the end of the year the world's sulfur industry was progressing slowly toward peacetime operation.

In Germany, Italy, and other countries that had been overrun, production halted; and in the succeeding period of reorganization, revival by the military governments was retarded by physical shortages, destruction of facilities, and purely economic barriers, such as unfavorable rates of exchange.

Conditions in Europe were too chaotic to allow full-scale reestablishment of the export trade of Spain, Portugal, and other large pyrites producers.

Although the end of hostilities removes much of the immediate need for development of domestic sulfur resources by importing countries, sulfur is so vital to modern industry that efforts to attain self-sufficiency continued in many countries.

As the pyrites group of minerals is the principal source of sulfur in the Eastern Hemisphere and native sulfur in the Western, the course of the war is reflected in the production figures. Official statistics are not yet available for many countries, but it is known that world production of pyrites sank to a low level in 1945, whereas native sulfur reached a new high.

As Italy was going through a difficult period of transition, its output of sulfur was small, but in the United States the industry established new records in production, consumption, and even in exports. Substantial tonnages were drawn from stocks to help meet the demands, but the stocks were never depleted to a danger point. Sales declined moderately after the end of the war.

Production and consumption of pyrites in the United States declined slightly in 1945, and imports from Spain remained relatively low.

Allocation of sulfuric acid by the War Production Board was found to be necessary in a few areas, but not of sulfur. Neither was pricing a problem for Government agencies as the price of sulfur, under the provisions of the General Maximum Price Regulation, remained stable.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

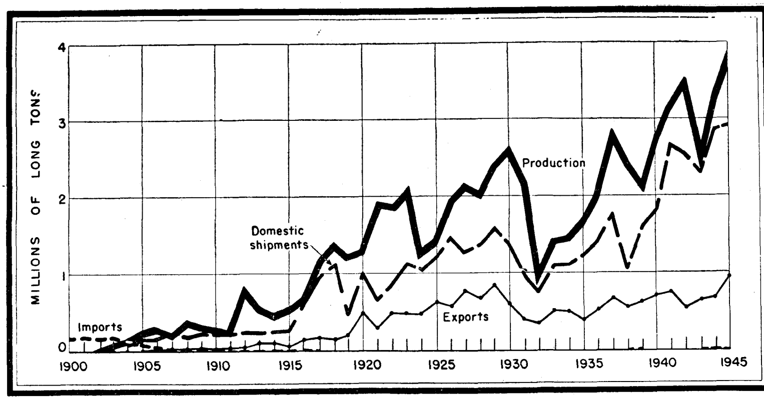

FIGURE 1.—Domestic production, shipments for domestic consumption, exports, and imports of crude sulfur, 1900–1945

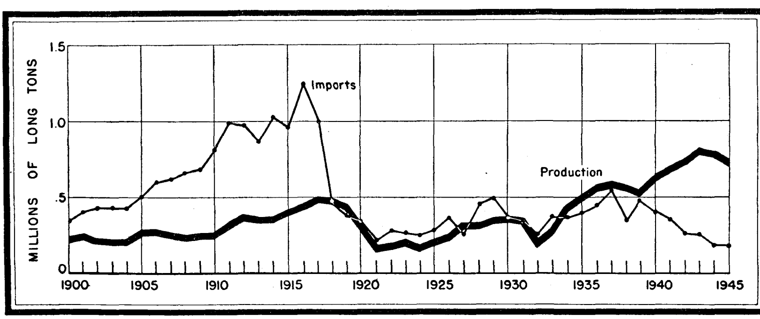

FIGURE 2.—Domestic production and imports of pyrites, 1900–1945

Salient statistics of the sulfur industry in the United States, 1935–39 (average) and 1942–45

	1935–39 (average)	1942	1943	1944	1945
Sulfur:					
Production of crude sulfur..long tons..	2,175,057	3,460,686	2,538,786	3,218,158	3,753,188
Shipments of crude sulfur—					
For domestic consumption.do....	1,420,236	2,560,310	[1] 2,296,452	2,865,397	2,914,603
For export.....do....	566,361	568,249	657,393	653,686	918,691
Total shipments.....do....	1,986,597	3,128,559	2,953,845	3,519,083	3,883,294
Imports:					
Ore.....do....	555				
Other.....do....	3,427	25,632	16,658	32	33
Exports of treated sulfur.....do....	16,374	17,030	25,079	21,546	23,971
Producers' stocks at end of year [2]..do....	3,560,000	4,300,000	3,800,000	3,500,000	3,500,000
Price of crude sulfur per long ton f. o. b. mines..	$17.40	$16	$16	$16	$16
Pyrites:					
Production.....do....	544,144	720,363	802,384	788,530	722,596
Imports.....do....	433,485	300,140	256,308	180,843	186,507
Price of imported pyrites c. i. f. Atlantic ports. cents per long-ton unit..	12–13	[3] 12	14	14	14
Sulfuric acid: Production of byproduct sulfuric acid (60° B.) at copper and zinc plants.....short tons..	727,172	960,764	[1] 1,228,098	[1] 1,160,023	1,084,891

[1] Revised figures. [2] Stocks held at mines only. [3] Nominal.

FUTURE OUTLOOK

Having weathered the war and the first months of the reconversion period, the native sulfur industry in the United States looks forward with confidence.[2] It has a product unexcelled in quality, an established and growing market, large production capacity, ample stocks above ground, large reserves, low production costs, and few serious competitors. Sales were lower at the end of the year, but volume is likely to be large while American industry satisfies the current demand for consumers' goods.

Domestic pyrites are relatively well established where currently mined and used, but its opportunities for expansion appear to be very limited. Prices are unfavorably low.

SULFUR

DOMESTIC PRODUCTION

Increasing demands for acid during the last year of the war stimulated a record production of sulfur in 1945—8 percent greater than the previous high, set in 1942. Although sales declined after the end of the war, production continued at a high level throughout the year. Shipments from the mines were 9 percent greater than in 1944 and larger than in any previous year. In addition to the sulfur from Frasch-process mines, a small tonnage of sulfur-bearing ore is mined in Colorado and Texas for agricultural use.

REVIEW BY STATES

Texas furnished over 79 percent and Louisiana almost 21 percent of the native sulfur output of the United States in 1945.

Sulfur produced and shipped in the United States, 1941–45

Year	Produced (long tons)				Shipped	
	Texas	Louisiana	Other States [1]	Total	Long tons	Approximate value
1941	2, 596, 731	533, 620	8, 902	3, 139, 253	3, 401, 410	$54, 400, 000
1942	2, 885, 621	570, 345	4, 720	3, 460, 686	3, 128, 559	50, 100, 000
1943	1, 908, 581	630, 205	----------	2, 538, 786	2, 953, 845	47, 300, 000
1944	2, 582, 238	635, 920	----------	3, 218, 158	3, 519, 083	56, 300, 000
1945	2, 969, 778	783, 410	----------	3, 753, 188	3, 833, 294	61, 300, 000

[1] 1941: California; 1942: California and Utah.

Colorado.—Thomas Sulphur Co. mined sulfur ore in Delta County.

Louisiana.—Output from the Grande Ecaille mine of the Freeport Sulphur Co. in Plaquemines Parish increased to 783,410 long tons in 1945.

Texas.—The following companies operated in Texas in 1945: Duval Texas Sulphur Co. at Orchard Dome, Fort Bend County; Freeport Sulphur Co., at Hoskins Mound, Brazoria County; Jefferson Lake Sulphur Co., Inc., at Clemens Dome, Brazoria County; Texas Gulf Sulphur Co., at Boling Dome, Wharton County; and the Pecos Orla Sulphur Co., at the Michigan claims in Culberson County. At the year end, construction and installation of facilities at the Long Point Dome property of Jefferson Lake Sulphur Co. were well advanced. The company expects to bring this mine into production in 1946. The following table was compiled from information supplied by the Texas State Comptroller's Office.

[2] Claiborne J. T., No Reconversion Problems for Sulfur: Min. Cong. Jour., vol. 32, No. 2, February 1946, pp. 67–68.

Sulfur produced in Texas in 1945, by companies, in long tons

Company	First quarter	Second quarter	Third quarter	Fourth quarter	Total
Texas Gulf Sulphur Co	492,640	536,573	596,531	577,673	2,203,417
Freeport Sulphur Co	93,625	101,625	99,340	100,475	395,065
Jefferson Lake Sulphur Co., Inc	55,972	49,282	36,179	48,393	189,826
Duval Texas Sulphur Co	37,765	47,610	49,995	46,100	181,470
Total	680,002	735,090	782,045	772,641	2,969,778

RECOVERY AS BYPRODUCT

In the United States native sulfur serves as our principal source of sulfur, and some deposits of pyrites are also mined primarily for the sulfur that can be derived from them. In addition to these, we obtain substantial quantities as byproducts of other commodities.

Copper and zinc ores yield large tonnages of pyrites that are recovered as flotation concentrates in milling. Some of our domestic coals contain massive "coal brasses" that can be easily separated by washing and jigging. These are included in the Pyrites section of this chapter.

Smelting of copper, zinc, and lead ores liberates voluminous sulfur oxide fumes that are a nuisance if released to the atmosphere. For the dual purpose of eliminating this nuisance and recovering a salable byproduct, smelter fumes are converted to sulfuric acid or sulfur. The equivalent of 275,000 long tons of sulfur was recovered from this source in 1945. The following table shows the output of acid at smelters during the past 5 years.

Byproduct sulfuric acid [1] (expressed as 60° B.) produced at copper and zinc plants in the United States, 1941–45, in short tons

	1941	1942	1943	1944	1945
Copper plants [1]	243,812	265,522	348,832	320,572	298,309
Zinc plants	672,177	695,242	[2] 879,266	[2] 839,451	786,582
	915,989	960,764	[2] 1,228,098	[2] 1,160,023	1,084,891

[1] Includes sulfuric acid produced as byproduct at a lead smelter.
[2] Revised figures.

Elemental sulfur is also obtained from coke-oven, refinery, natural, and other industrial gases by the Thylox, Ferrox, and Nickel processes. Elemental sulfur recovery plants are located in 11 States and in 1945 produced 25,184 long tons (calculated as 100 percent sulfur), of which 11,691 tons were shipped. Some of this material is marketed as a paste containing 35 to 50 percent of sulfur, but 79 percent is sold as brimstone.

Fuel gases also yield sulfur in the form of hydrogen sulfide through the Phenolate, Phosphate, and Girbotol processes. The product is usually converted to sulfuric acid or burned as fuel. Hydrogen sulfide, recovered in three States in 1945, contained 19,308 long tons of sulfur.

STOCKS

Notwithstanding the high rate of output in 1945, producers' stocks declined steadily during the first 7 months of the year, and after the surrender of Japan they increased. For the year as a whole, total stocks decreased 2 percent to 4,003,917 long tons, of which 3,459,609 were held at the mines.

PRICES

Throughout 1945 crude sulfur was quoted by trade journals at $16 per long ton f. o. b. mines.

CONSUMPTION AND USES

Although available statistics and estimates indicate that consumption of native sulfur in the United States attained a new record in 1945, the quantity appears to have been very little more than in 1944. Total sales, including exports, apparently were about 9 percent greater than in 1944.

Apparent consumption of sulfur in the United States, 1941–45, in long tons

	1941	1942	1943	1944	1945
Shipments [1]	3,076,038	3,032,043	3,191,051	3,580,058	3,849,591
Imports	28,631	25,632	16,658	32	33
Total	3,104,669	3,057,675	3,207,709	3,580,090	3,849,624
Exports:					
Crude	729,464	568,249	657,393	653,686	918,691
Refined	31,312	17,030	25,079	21,546	23,971
Total	760,776	585,279	682,472	675,232	942,662
Apparent consumption	2,343,893	2,472,396	[2] 2,525,237	2,904,858	2,906,962

[1] Apparent shipments to consumers. [2] Revised figure.

The pattern of sulfur consumption, by industry, has been estimated by Chemical and Metallurgical Engineering as follows:

Sulfur consumed in the United States, 1941–45, by uses, in long tons

Use	1941	1942	1943	1944	1945
Chemicals [1]	1,060,000	1,260,000	1,320,000	1,585,000	1,605,000
Fertilizer and insecticides	450,000	475,000	580,000	580,000	600,000
Pulp and paper	360,000	365,000	305,000	300,000	297,000
Explosives [1]	83,000	90,000	90,000	88,000	90,000
Dyes and coal-tar products	65,000	60,000	65,000	75,000	75,000
Rubber	55,000	35,000	45,000	55,000	58,000
Paint and varnish	65,000	70,000	80,000	90,000	94,000
Food products	6,000	6,000	7,000	7,000	7,000
Miscellaneous	95,000	110,000	120,000	140,000	135,000
Total	2,239,000	2,471,000	2,532,000	2,920,000	2,961,000

[1] To avoid disclosing estimated consumption of sulfur in direct defense applications, such as military explosives, sulfur so used is included under "Chemicals."

Sulfur is used in elemental form in a wide variety of products, including rubber and insecticides, and a large tonnage is oxidized for use in papermaking. About three-fourths of the total sulfur, from all sources, is burned and converted into sulfuric acid—the inexpensive and highly effective acid that serves virtually every industry. Chemical and Metallurgical Engineering has estimated the consumption of sulfuric acid, by industries, from 1943 through 1945 as follows:

Sulfuric acid (basis, 100 percent) consumed in the United States, 1943–45, by industries, in short tons

Industry	1943	1944	1945
Fertilizer	2,500,000	2,620,000	2,800,000
Petroleum refining	940,000	1,020,000	1,070,000
Chemicals and defense [1]	2,285,000	2,425,000	2,240,000
Coal products	580,000	620,000	585,000
Iron and steel	535,000	560,000	580,000
Other metallurgical	360,000	340,000	320,000
Paints and pigments	495,000	530,000	545,000
Industrial explosives	115,000	110,000	115,000
Rayon and cellulose film	415,000	450,000	495,000
Textiles	85,000	75,000	70,000
Miscellaneous	350,000	340,000	310,000
Total	8,660,000	9,090,000	9,130,000

[1] To avoid disclosing estimated consumption of acid in direct defense applications, such as military explosives, acid so used is combined with "Chemicals."

Less than 1 percent more acid was consumed in 1945 than in 1944. Consumption in fertilizers continued to increase, and the "Chemicals and defense" total declined. Throughout the war, shortages persisted in some areas, particularly in the West, but they never reached a critical stage for the essential requirements. Reuse and regeneration of spent acids, construction of a comparatively moderate number of new acid plants, and operation of many plants at well over their rated capacities all combined to keep pace with requirements.[3] During the war new construction increased sulfuric acid capacity approximately 2,380,000 tons to a total of about 10,500,000.[4] Conversion problems were not nearly as acute as in many other essential industries. Although consumption for military explosives declined, the effect was relatively small, owing to the high percentage of salvage of ordnance acid. The major consuming industries, such as fertilizer, petroleum, chemicals, steel, paper, rubber, and fibers, can be as active in prosperous peacetime as in wartime, and some are more so.

FOREIGN TRADE

Unlike most of the domestic nonmetallic minerals, a substantial proportion of our sulfur production is sold to foreign consumers. In 1945 nearly a million tons—25 percent of the quantity produced—were exported. The accompanying table shows the world-wide distribution of these shipments. With the end of the war substantial quantities have begun to move into Europe. Imports have been negligible during the past 2 years.

The Federal Trade Commission conducted hearings to determine whether the operations of the Sulphur Export Corporation were conforming to the provisions of the export trade laws.

Sulfur exported from the United States, 1944–45, by countries

Country	Crude				Crushed, ground, refined, sublimed, and flowers of			
	1944		1945		1944		1945	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
North America:								
Canada	208,028	$4,616,749	217,407	$4,502,387	6,805,911	$191,705	8,351,013	$203,156
Central America	138	5,488	188	7,844	519,145	20,510	495,130	20,605
Mexico	2,585	59,761	3,189	73,473	3,120,834	71,094	2,314,512	64,715
Newfoundland and Labrador	9,201	158,237	11,069	190,139	3,000	160	4,000	230
West Indies	26,105	450,255	21,299	370,164	710,277	21,240	307,237	18,117
Other North America					1,375	83	1,634	98
	246,057	5,290,490	253,152	5,144,007	11,160,542	304,792	11,473,526	306,921
South America:								
Argentina	15,550	279,900	16,155	290,790	22,200	7,416	948,035	18,135
Brazil	24,284	467,818	21,961	399,342	8,212,066	217,344	4,785,768	130,514
Chile					7,643	513	1,734	185
Colombia	348	7,725	610	14,542	168,729	5,475	441,080	13,866
Ecuador	1	97	18	1,180	87,960	2,679	230,329	7,462
Peru	50	1,156			596,547	16,005	884,936	33,983
Uruguay	4,200	75,600	3,500	63,000	764,323	13,736	1,748,649	31,433
Venezuela			4,000	67,648	309,941	9,684	162,339	5,349
Other South America	76	2,908	45	1,198	140,338	4,079	645,978	11,660
	44,509	835,204	46,289	837,700	10,309,747	276,931	9,848,848	252,587

[3] Chemical and Metallurgical Engineering, Enough Sulphur and Sulphuric Acid: Vol. 53, No. 1, January 1946, pp. 98–99.
[4] White, Alonzo, Sulfuric Acid: Chem. and Eng. News, vol. 23, No. 13, July 10, 1945, pp. 1154–1159.

Sulfur exported from the United States, 1944–45, by countries—Continued

Country	Crude				Crushed, ground, refined, sublimed, and flowers of			
	1944		1945		1944		1945	
	Long tons	Value	Long tons	Value	Pounds	Value	Pounds	Value
Europe:								
Belgium and Luxembourg			45,185	$779,015			3,264,555	$74,230
Czechoslovakia							1,119,750	18,977
Eire					156,800	$3,515	112,000	2,733
France			127,755	2,212,387			320,500	5,120
Greece							1,054,700	21,811
Malta, Gozo, and Cyprus Islands					751,440	18,459	771,500	16,497
Netherlands							1,983,656	48,139
Norway							50,000	1,325
Sweden			3,252	56,892			69,180	2,418
Switzerland			13,599	245,268			1,236,530	29,235
United Kingdom	200,664	$3,145,823	198,826	3,147,477	75,050	24,656	165,642	52,118
Yugoslavia			219	8,750			499,950	9,999
Other Europe	2,500	45,000	18,872	343,854	34,754	1,457	27,676	579
	203,164	3,190,823	407,708	6,793,643	1,018,044	48,087	10,675,639	283,181
Asia:								
Ceylon	39	2,058			2,801,131	76,109	1,765,680	39,129
China							67,200	1,290
India and Dependencies	25,990	541,986	16,897	344,785	7,572,635	120,519	491,642	209,251
Iran	11,218	244,808	15,153	368,950			1,270	61
Palestine and Trans-Jordan	2,392	54,931	2,081	42,274	2,319,385	50,755	440,344	9,964
State of Bahrein	664	21,388	2,940	84,549	1,490,935	21,661	1,487,450	21,395
Syria					403,200	9,088	1,156,700	27,160
Turkey					2,299,537	37,524	4,109,674	146,498
Other Asia			196	5,154	100,000	2,263	3,782	182
	40,303	865,171	37,267	845,712	16,986,823	317,919	9,523 742	454,930
Africa:								
Algeria			19,745	348,167	2,202,873	42,252	4,117,991	104,131
Belgian Congo					10,756	581	14,044	884
British East Africa	211	11,956			336,652	9,026	5,240	460
Egypt	695	22,017	694	22,484	3,056,795	75,229	4,619,867	115,963
French West Africa					12,300	373	11,340	390
Madagascar					478,680	13,747	6,100	335
Mauritius and Dependencies					903,400	21,816		
Morocco, French							1,580,945	36,691
Mozambique	200	4,940	98	1,923			224,160	5,843
Nigeria					55,300	1,907	4,400	488
Union of South Africa	31,080	536,155	30,725	525,828	1,519,550	78,564	1,179,830	58,454
Other Africa			3,356	60,408	4,768	394	4,899	520
	32,186	575,068	54,618	958,810	8,581,074	243,889	11,768,816	324,159
Oceania:								
Australia	36,477	618,085	68,762	1,184,242	151,472	5,483	99,051	5,438
New Zealand	50,990	861,446	50,895	879,007	47,604	1,367	296,749	7,415
Other Oceania					7,285	221	9,705	312
	87,467	1,479,531	119,657	2,063,249	206,361	7,071	405,505	13,165
	653,686	12,236,287	918,691	16,643,121	48,262,591	1,198,689	53,696,076	1,634,943

Sulfur imported into and exported from the United States, 1941–45

Year	Imports [1]		Exports			
	In any form, n. e. s.		Crude		Crushed, ground, refined, sublimed, and flowers of	
	Long tons	Value	Long tons	Value	Long tons	Value
1941	28,631	$487,758	729,464	$12,520,068	31,312	$1,360,683
1942	25,632	442,811	568,249	10,942,703	17,030	911,598
1943	16,658	343,083	657,393	12,521,502	25,079	1,384,016
1944	32	9,942	653,686	12,236,287	21,546	1,198,689
1945	33	10,197	918,691	16,643,121	23,971	1,634,943

[1] No imports of sulfur ore reported 1941–45, but processors state that in 1945 at least 2,000 tons of sulfur ore were imported from Mexico.

WORLD PRODUCTION

Although deposits of sulfur are distributed rather widely, most of them are small, low-grade, or inaccessible. Most of the output is concentrated in a few countries. Production statistics from many countries are not yet available for the past few years; but it is estimated that world production of elemental sulfur, including that derived from gases, totaled about 4,300,000 long tons in 1945.

World production of native sulfur, 1938–45, by countries, in long tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	-------	-------	-------	367	2,148	11,810	(2)	(2)
Bolivia (exports)	1,632	2,126	4,065	2,315	3,535	7,079	6,151	640
Chile	20,959	26,999	32,440	28,745	29,570	32,360	30,380	(2)
Ecuador	68	72	(2)	(2)	-------	61	13	(2)
France (content of ore)	140	(2)	309	575	703	714	1,146	(2)
Greece	75	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Guatemala	15	12	11	(2)	[3] 10	[3] 10	-------	(2)
Italy (crude) [4]	374,339	350,208	325,473	294,288	223,400	[5] 91,773	[3] 37,000	[3] 80,000
Japan	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Mexico	49	(2)	(2)	(2)	[6] 26,115	[6] 27,900	[6] 29,000	(2)
Netherlands East Indies	15,986	17,293	(2)	(2)	(2)	(2)	(2)	(2)
Palestine	1,196	829	1,358	3,365	(2)	(2)	(2)	(2)
Peru	1,944	571	610	935	1,126	564	601	[3] 640
Spain [7]	990	3,770	3,560	6,230	5,000	5,511	5,700	(2)
Turkey	3,684	2,560	[3] 2,600	[3] 2,600	[3] 2,600	3,326	3,348	[3] 3,000
United States	2,393,408	2,090,979	2,732,088	3,139,253	3,460,686	2,538,786	3,218,158	3,753,188
Estimated world total	3,000,000	2,700,000	3,300,000	3,700,000	4,000,000	3,000,000	3,500,000	4,100,000

[1] Native sulfur believed to be produced also in China, Cuba, Egypt, India, Iran, Taiwan, and U. S. S. R., but complete data not available.
[2] Data not available.
[3] Estimate.
[4] In addition, following quantities of sulfur rock reported—1938, 16,545 tons; 1939, 19,568. Similar data not available for later years.
[5] Production of Sicily for fiscal year ended July 31 of year stated.
[6] The incomplete data cited is crude sulfur ore; total production and sulfur content are unknown.
[7] Estimated sulfur content of ore, excluding sulfur made from pyrites.

Argentina.—Under difficult mountain conditions Argentina is continuing to develop a substantial deposit of volcanic sulfur south of Socompa. Although sulfur from this operation is unlikely to become an active competitor in the world market, it can eventually supply domestic needs. With present equipment it can probably furnish not over half of Argentina's requirements; but planned improvements in machinery, transportation, and construction of living quarters for workmen may expand output to over 30,000 metric tons a year, approximately the level of Argentine consumption.

Chile.—Sulfur output in Chile was limited to the level of domestic consumption plus sales, totaling somewhat over 10,000 tons, to Argentina. Competition in the world market is restricted by the cost of production—about $35.00 per ton—and by increases in freight rates and handling costs at the port.

Ecuador.—In the Parish of Tixan, Canton Alausi, Chimborazo Province, are deposits of high-grade sulfur near a railroad. Production is negligible, but the Government is attempting to establish an industry.

Egypt.—Development of two small deposits on the coast of the Red Sea, at Jemsa and Ranga, Egypt, has been reported. Production increased from 130 tons in 1942 to 860 tons in 1944.[5]

Italy.—The Italian sulfur industry has been badly disrupted by the war. From 1937–41 Italian production averaged 340,000 tons a year, of which 65 percent was exported. Owing to the invasion, production was suspended in August 1943. Although output was resumed on a minor scale in December 1943, a combination of military restrictions, power, and supply shortages, and economic difficulties has depressed the industry since that time. Production in 1944 totaled 38,000 metric tons and in 1945 approximately 81,000. This somewhat exceeds domestic consumption, which is currently smaller than before the war. Over 50,000 tons of accumulated stock were available for export early in 1946. As most of the mines are relatively undamaged, they could soon be brought into full production if sufficient supplies, power, and market were available. Before the war European consumers took a large fraction of Italy's sulfur output, but reestablishment of this trade is delayed by monetary and political disturbances. Inflation within Italy has multiplied costs of production 13 to 15 times since 1943. This has been partly counterbalanced by adjustments in the rates of exchange, but with American sulfur delivered in Europe at about $30.00 per ton and Sicilian sulfur priced at 9,500 lire f. o. b. Sicilian ports a ratio of over 300 lire per dollar would be required to make them competitive, assuming other currencies are in relative balance. In 1945 the rate of exchange was 100 lire per dollar, and shortly after the end of the year it was raised to 225.

Characteristically the Italian industry is organized and to some degree controlled by trade and marketing associations. In 1945 Ente Zolfi Italiani and Ente Zolfi Siciliani were dissolved and replaced by voluntary groups named Unione Nazionale Zolfi, in Rome, and Consorzio Zolfifero Siciliano in Palermo. Through these organizations producers hope to develop and apportion the internal and export markets. From 1935–39 output was distributed as follows: Calabria produced 0.2 percent; Benevento area 3.6; Ancorria, Pesaro, and Flori Provinces 41.3; and Sicily 54.9 percent.[6]

Near East.—Sulfur is known to exist in many deposits in the Near East. Some of them have been worked, but the operations are on a small scale. During the past year there have been reports of activity in various localities.[7] A volcanic deposit is said to exist on the island of Gebel Tier, Aden. Oil prospect drilling has penetrated sulfur in Kuweit, Arabia. A small quantity is found in the overburden of pyrite ore bodies in Cyprus. Deposits are known in the Semnan and the Bandar Abbas areas of Iran and in the Tigris Gorge in Iraq.

[5] Mining Journal, vol. 226, No. 5768, Mar. 9, 1946, p. 187.
[6] Botsford, C. A., Sulfur Industry of Italy: Bureau of Mines Mineral Trade Notes, vol. 21, No. 6, Dec. 20, 1945, pp. 41–47.
[7] Chemical Age (London), vol. 54, No. 1395, Mar. 23, 1946, p. 322.

In the Ghaza district of Palestine output of 1,248 tons was reported in 1940, but the easily available reserves are said to have been depleted. In the Palmyra Grottos in Syria and Lebanon sulfur is found associated with gypsum.[8]

Turkey.—Two mines, one at Keciburlu, Isparta, and the other at Saraykoy, Teketirkaz, Denizli, supply over half of Turkey's requirements for elemental sulfur. Keciburlu produced 3,327 metric tons in 1944 and Saraykoy 75. Exploration has revealed new deposits near Keciburlu that are expected to increase production in the future. A reserve of 500,000 tons of ore averaging 33 percent sulfur has been revealed.[9]

PYRITES

DOMESTIC PRODUCTION

Production of pyrites in the United States declined 8 percent in 1945; 91 percent of the total was classified as fines and the remainder as lump.

Pyrites (ores and concentrates) produced in the United States, 1941–45

Year	Quantity		Value	Year	Quantity		Value
	Gross weight (long tons)	Sulfur content (percent)			Gross weight (long tons)	Sulfur content (percent)	
1941	645, 257	41. 9	$2, 009, 000	1944	788, 530	42. 2	$2, 598, 000
1942	720, 363	42. 6	2, 464, 000	1945	722, 596	41. 0	2, 700, 000
1943	802, 384	42. 0	2, 844, 000				

Owing to the strong competition of native sulfur a comparatively small fraction of the output of pyrites is sold on the open market. Most of it is converted to acid by the producing companies in areas that have a market nearby. In 1945, 587,899 tons were consumed by the producing companies, and 130,763 tons were sold.

REVIEW BY STATES

California.—Virtually all the pyrites recovered in California in 1945 came from the Hornet mine of the Mountain Copper Co. in Shasta County.

Colorado.—Only the Rico Argentine Mining Co. reported pyrites output in Colorado in 1945. Its mine is in Dolores County.

Illinois.—The Midland Electric Coal Corp. separated 6,861 long tons of "coal brasses" as a salable byproduct at its coal-washing plant in Henry County in 1945.

Indiana.—Pyrites (coal brasses) were recovered and sold by the Snow Hill Coal Corp. from its Talleydale mine in Vigo County.

Montana.—Pyrites were recovered as a flotation-concentrate byproduct of copper plant operations by the Anaconda Copper Mining Co. in Deer Lodge County.

New York.—In 1945 the St. Joseph Lead Co. mined pyrites at the Balmat mine in St. Lawrence County.

Pennsylvania.—Pyrites were produced by the Bethlehem Steel Co. in Lebanon County.

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[8] Work cited in footnote 5.
[9] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 6, Dec. 20, 1945, p. 46.

Tennessee.—Owing to the large output by the Tennessee Copper Co. in Polk County, Tennessee was the leading pyrites-producing State in 1945.

Virginia.—The General Chemical Co. mined pyrites at the Gossan mine in Carroll County and converted it to acid at Pulaski.

Wisconsin.—Pyrites were recovered and converted into acid by the Vinegar Hill Zinc Co. in Grant County.

FOREIGN TRADE

Restrictions in the supply of pyrites during the war have reduced the American market for foreign pyrites. As shown in the accompanying table, movement from Spain was nearly cut off. Increased shipments from Canadian producers to East coast plants satisfied part of the demand for a time, but exhaustion of the Aldermac mine limited this supply. Canada has many other potential sources of byproduct pyrites; but transportation costs were relatively high and prospective prices were so unattractive that all of the needed tonnage did not appear. Consequently, native sulfur replaced the missing pyrites. Recapture of the American market has been made more difficult for pyrites by the abandonment of older pyrites-consuming acid units in favor of new plants designed to use native sulfur.

Imports from Canada have been declining since 1942, and those from Spain are still relatively small. The total tonnage of foreign pyrites imported into the United States in 1945 was slightly greater than in 1944 but was only 39 percent as large as the 482,336 tons that entered in 1939.

Such factors as low production costs and favorable rates of monetary exchange may again furnish foreign pyrites with advantages in its future competition with native sulfur, but at present it appears to be at a disadvantage in the United States.

Spanish pyrites have been variously quoted in trade journals at 12 to 20 cents per unit of sulfur; one well-informed company in the trade reports that 14 cents closely approximates the actual market value of foreign pyrites delivered to the East coast.

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1941–45, by countries

Country	1941		1942		1943		1944		1945	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Canada	244,287	$1,151,964	282,897	$1,313,295	197,750	$683,110	166,655	$302,892	137,238	$276,832
Mexico	320	1,500	682	2,995	273	916			57	160
Norway									1,150	1,725
Spain	124,231	326,052	16,561	43,866	58,285	147,533	14,188	36,896	48,062	133,900
	368,838	1,479,516	300,140	1,360,156	256,308	831,559	180,843	339,788	186,507	412,617

As the major markets for foreign pyrites are along the eastern seaboard, imports from Canada usually enter through the Buffalo customs district and sea-borne material at Philadelphia and other Atlantic ports. The accompanying table shows the quantities reported during the past few years.

Pyrites, containing more than 25 percent sulfur, imported for consumption in the United States, 1941–45, by customs districts, in long tons

Customs district	1941	1942	1943	1944	1945
Buffalo	227,510	225,924	159,483	134,955	152,266
Maryland	24,231	12,561	10,357		
Massachusetts		82	69		
Michigan	12,569	29,163	28,051	29,865	
Montana and Idaho		366			
New York	317				16,891
Ohio		1	71	1	
Philadelphia	88,219	6,102	47,928	14,188	17,350
St. Lawrence		80			
San Diego	320	732	273		
Vermont	3,889	15,440	8,562		
Virginia	11,781	4,000			
Washington	2	5,689	1,514	1,834	
	368,838	300,140	256,308	180,843	186,507

WORLD PRODUCTION

In the United States native sulfur can be produced so inexpensively that it dominates the market. On the other hand, in most of Europe and in many other areas pyrites have a competitive advantage. As shown in the accompanying table, statistics of production are still far from complete for the past few years, but from available information it seems doubtful that world output of pyrites greatly exceeded 6,000,000 tons in 1945.

Brazil.—A total of 3,000 to 4,000 metric tons of pyrite are mined annually by three companies in the Ouro Preto area of Minas Gerais.[10]

Canada.—Byproduct pyrites are recovered at the Waite Amulet and Noranda mines in Quebec and the Britannia mine in British Columbia. Mine shipments totaled 227,733 short tons in 1945. Sulfur in smelter gas is recovered in elemental form at Trail, British Columbia, and as sulfuric acid at Copper Cliff, Ontario.[11]

France.—Production of pyrite in France in 1940–44 averaged about 200,000 metric tons annually. Approximately 150,000 tons came from the Sain-Bel mine near Lyon, Department of Rhone. From 20,000 to 40,000 tons were produced by the Chizeuil mine near Chalmoux, Department of Saone-et-Loire. Both mines are operated by Société des Manufactures de Glacés et Produits Chimiques de Saint-Gobain, Chauny et Cirey. The remainder (20,000–25,000 tons) came from the Soulier mine near Saint-Martin-de-Valgalgues, Department of Gard. It is owned by Compagnie d'Alais, Froges et Camargue.

Germany.—A report by the Office of Military Government (United States) indicates that production of pyrites in Germany increased from an average of 201,000 metric tons in 1932–34 to 1,397,000 in 1943. This expansion came principally from the Meggen mine of Sachtleben A. G. in Westphalia. This mine alone contributed 1,052,608 tons in 1943, from an unusually large and high-grade vein of sedimentary origin. Reserves are estimated to be at least 5 million tons and possibly up to 23,000,000. The mine suffered no war damage, and it has been put back into limited operation by the

[10] Walker, Jay, Bureau of Mines Mineral Trade Notes: Vol. 21, No. 4, Oct. 20, 1945, pp. 44–45.
[11] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 4, Apr. 20, 1946, p. 45.

World production of pyrites (including cupreous pyrites), 1938 and 1942–45, by countries, in metric tons[1]

[Compiled by B. B. Waldbauer]

Country[1]	1938		1942		1943		1944		1945	
	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content	Gross weight	Sulfur content
Algeria	44,150	19,430	35,820	15,716	27,337	11,000	32,941	13,506	(2)	(2)
Australia:										
Tasmania	51,084	(2)	35,002	(2)	33,736	(2)	29,787	(2)	(2)	(2)
Western Australia	----------	----------	374	(2)	10,353	(2)	24,082	(2)	(2)	(2)
Canada	40,464	20,300	344,268	165,813	258,162	126,505	226,859	110,470	206,595	99,974
Cyprus (exports)	523,574	256,551	5,051	(2)	13,198	(2)	(2)	(2)	(2)	(2)
Czechoslovakia[3]	(2)	(2)	[4] 10,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Finland	102,979	44,281	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
France	147,208	65,655	218,420	93,801	216,950	[4] 93,000	171,854	[4] 74,000	(2)	(2)
Germany	465,241	176,191	1,215,977	459,646	1,397,065	529,390	(2)	(2)	(2)	(2)
Greece	244,000	118,605	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Italy	930,312	386,079	970,624	[4] 446,000	(2)	(2)	(2)	(2)	102,508	[4] 49,000
Korea (Chosen)	132,614	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Norway	1,027,776	446,939	822,207	(2)	808,779	(2)	(2)	(2)	(2)	(2)
Poland	92,209	36,883	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Portugal	558,327	251,250	128,280	[4] 57,720	109,994	[4] 49,500	131,890	[4] 59,400	170,967	[4] 76,900
Rumania	80,900	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Southern Rhodesia	27,065	10,900	[5] 39,941	(2)	[5] 36,905	(2)	[5] 33,698	(2)	(2)	(2)
Spain[6]	2,727,003	[4] 1,145,341	627,005	[4] 263,300	881,150	[4] 370,100	512,249	[4] 215,100	[7] 406,700	(2)
Sweden	186,390	84,345	(2)	(2)	(2)	(2)	[4] 200,000	(2)	(2)	(2)
Union of South Africa	31,017	13,947	40,467	17,959	37,030	16,195	36,155	15,859	(2)	[8] 12,662
Union of Soviet Socialist Republics	[4] 600,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	4,351	(2)	5,739	(2)	9,749	(2)	10,395	(2)	(2)	(2)
United States	564,547	222,612	731,925	311,885	815,262	342,134	801,186	337,790	734,194	301,000
Uruguay	70	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Yugoslavia	150,402	67,681	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Estimated world total	10,000,000	4,300,000	9,000,000	3,900,000	9,000,000	3,900,000	7,000,000	3,000,000	6,000,000	2,600,000

[1] In addition to countries listed, Belgium, Brazil, China, Egypt, Eire, Hungary, Iran, and Japan produced pyrites, but production data are not available.
[2] Data not available.
[3] Slovakia only.
[4] Estimate.
[5] Exports.
[6] Average sulfur content of pyrites was 42 percent in 1931, latest year for which such information was available.
[7] Incomplete data.
[8] January to September, inclusive.

British Military Government. The Waldsassen, Bavaria, mine of Bergbau G. m. b. H. supplied about 60,000 tons, and virtually all of the remainder came from coal-washing operations and as a byproduct from lead-zinc ores. In 1943 imports totaled 792,273 tons, about 450,000 of which came from Norway, 150,000 from Italy, and 90,000 from Yugoslavia.

In addition to sulfur derived from pyrites, Germany obtained a large tonnage from other sources. According to a German report, total recovery of sulfur (or its compounds) in 1943 was equivalent to 3,675,000 tons of sulfur trioxide. The sources were as follows: 1,900,000 tons from domestic and imported pyrites; 650,000 from regeneration of spent sulfuric acid; 240,000 as acid from copper and lead smelting, fuel and other industrial gases; 80,000 as acid from spent oxide; 95,000 as acid from gypsum; 250,000 as acid from zinc ores; 210,000 from imported elemental sulfur; and 250,000 tons from domestically produced elemental sulfur.

Italy.—Ordinarily Italy produces close to a million tons of pyrites a year, but in 1945 military activity forced the mines to suspend operation for long periods, and output was of the order of 100,000 tons. Owing to power shortages, many mines were flooded; but only one, the Niccioleta, was subjected to systematic destruction by the retreating forces. As power became available in the summer of 1945, pumping was begun, and in July and August the Boccheggiano, Niccioleta, and Gimigliano mines started producing on a small scale. Output can be brought up to normal in a few months when adequate supplies, power, and transportation become available. Italy consumes most of its pyrites—exports range from 50,000 to 200,000 tons a year.

Deposits are found in many Provinces. Their relative commercial importance is shown by production statistics for 1938. In that year Grossetto Province contributed 792,467 metric tons; Belluno Province, 43,586; Aosta, 40,496; Trento, 38,649; and others, 15,114. The principal mines in Grossetto Province are the Gavoranno (capacity, 30,000 tons of ore per month), the Boccheggiano (12,000 tons), the Niccioleta (20,000 tons), and the Ravi Marchi (5,000 tons). In Trento Province are the Andreolle mine and the Calceranica (rated at 5,000 tons per month). Belluno Province has the Agordo mine, which at present has a capacity of 3,000 tons per month. In Aosta are the Bore and Baoio, which produced 2,500 tons per month in 1943; the Herin mine (1,000 tons); and the Traversella (2,200 tons). In addition, pyrites have been prospected or mined on a small scale in the Provinces of Novara, Vercelli, Genova, and Sasseri, but output has been insignificant. Over 90 percent of the production comes from mines owned by Societa Montecatini.[12]

Portugal.—Foreign trade in Portuguese pyrites did not revive substantially in 1945; but output, principally for domestic fertilizer acid, increased to 170,967 metric tons—less than one-third capacity.

Spain.—As Spain's foreign markets had not fully reopened in 1945, its pyrites industry continued to coast along at a small fraction of its prewar volume.

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[12] Botsford, C. A., Bureau of Mines Mineral Trade Notes: Vol. 22, No. 2, Feb. 20, 1946, pp. 46–50.

PHOSPHATE ROCK

By Bertrand L. Johnson and E. M. Tucker [1]

SUMMARY OUTLINE

GENERAL CONDITIONS

Several new records were made in the domestic phosphate-rock industry in 1945. Total mined production reached a new high at 5,399,739 long tons, and the quantity mined in Florida (3,814,935 tons) and the Western States (323,955 tons) also set new records. Phosphate rock sold or used by producers in 1945 also made a new peak of 5,806,723 tons (see fig. 1), over 400,000 tons greater than in 1944, with a value of $23,951,077, in turn about 3 million dollars above the 1944 value. The marketed production from Florida and also the Western States was greater than ever before. Sales of Tennessee rock were less. Imports again increased markedly, reaching 141,658 long tons. Exports were greater by about 50,000 tons. Apparent domestic consumption reached nearly 5½ million tons. Stocks at the end of 1945 had decreased about one-third, the decline being chiefly in

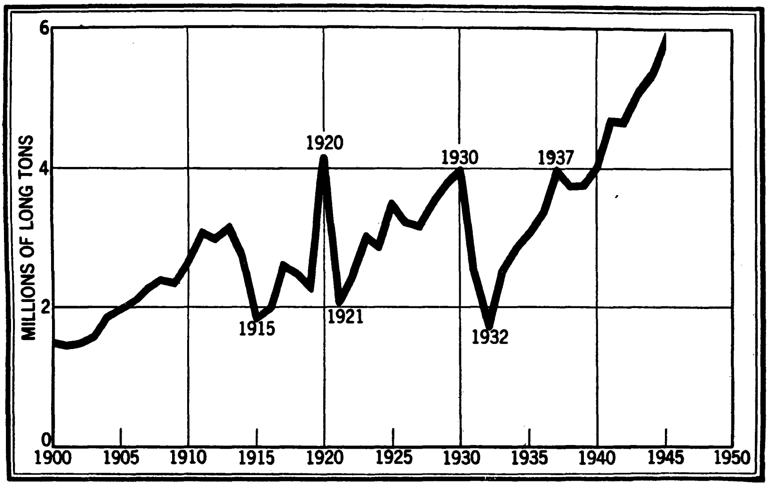

Figure 1.—Marketed production of domestic phosphate rock, 1900–1945.

[1] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Florida. The P_2O_5 content of the domestic phosphate rock sold or used in 1945 was at a new high—1,884,035 long tons.

Salient statistics of the phosphate-rock industry in the United States, 1944–45

	1944				1945			
	Long tons		Value at mines		Long tons		Value at mines	
	Rock	P_2O_5 content	Total	Average	Rock	P_2O_5 content	Total	Average
Production (mined)	5,200,002	1,673,860	(1)	(1)	5,399,739	1,737,185	(1)	(1)
Sold or used by producers:								
Florida:								
Land pebble	3,670,208	1,241,519	$13,136,472	$3.58	4,103,022	1,382,950	$15,578,980	$3.80
Soft rock	60,087	12,526	259,523	4.32	71,715	15,050	293,433	4.09
Hard rock	22,500	8,056	138,952	6.18	63,491	22,613	426,061	6.71
Total Florida	3,752,795	1,262,101	13,534,947	3.61	4,238,228	1,420,613	16,298,474	3.85
Tennessee [2] [3]	1,324,849	381,621	5,975,337	4.51	1,294,297	375,370	6,062,688	4.68
Idaho	112,565	35,804	584,400	5.19	123,340	38,984	673,627	5.46
Montana	186,434	59,963	761,745	4.09	150,858	49,068	916,288	6.07
Virginia	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total United States	5,376,643	1,739,489	20,856,429	3.88	5,806,723	1,884,035	23,951,077	4.12
Imports [4]	123,414	(1)	1,005,132	8.14	141,658	(1)	1,112,526	7.85
Exports	438,133	(1)	[5] 3,460,916	[5] 7.90	[6] 489,566	[6] 166,090	[6] 2,774,144	[6] 5.67
Apparent consumption [7]	5,061,924	(1)			5,458,815	(1)		
Stocks in producers' hands, December 31:								
Florida	815,000	273,000	(1)	(1)	388,000	129,000	(1)	(1)
Tennessee [2] [3] [8]	410,000	115,000	(1)	(1)	411,000	113,000	(1)	(1)
Western States	2,000	1,000	(1)	(1)	47,000	15,000	(1)	(1)
Total stocks	1,227,000	389,000	(1)	(1)	846,000	257,000	(1)	(1)

[1] Data not available.
[2] Includes sintered matrix.
[3] Virginia included with Tennessee.
[4] Market value (or price) at port and time of exportation to the United States.
[5] Value at port of exportation.
[6] Quantity and value f. o. b. mines as reported by producers.
[7] Quantity sold or used by producers plus imports minus exports.
[8] Includes brown-rock matrix of sinter grade, sintered brown rock, blue rock, and some matrix of washer grade.

OUTLOOK

Unsatisfactory conditions still prevail in the world's phosphate-rock industry and appear likely to continue for a considerable time. Rehabilitation of the industry in the former major producing countries in Africa and the Far East has been slow. The situation resulting from the shortage of phosphate supplies due to these delays is aggravated by the threat of famine in many countries. In the United States the production of phosphate rock is still supported by the Government guaranty of 90 percent parity to farmers, together with the demand for export crops and fertilizer for export. The abnormal domestic production and consumption of phosphate rock may be expected to continue pending recovery in other producing areas, satisfaction of demands from nonproducing, phosphate-consuming countries, disappearance of the famine threat, or major financial difficulties.

PRODUCTION

A new high record was made in 1945 in the quantity of phosphate rock mined in the United States, with a total of 5,399,739 long tons. The increase was due largely to the much greater quantity mined in Florida and to a smaller extent to the increase in the mined production of the Western States. These more than counterbalanced the considerable decline in Tennessee. Phosphate rock was mined in 1945 in Florida, Tennessee, Montana, and Idaho and apatite in Virginia.

Phosphate rock mined in the United States, 1935–45, by States, in long tons

Year	Florida	Tennessee [1]	Western States	United States	Year	Florida	Tennessee [1]	Western States	United States
1935	2,598,337	493,501	67,490	3,159,328	1941	3,417,900	[3] 1,301,067	203,216	4,922,183
1936	2,645,819	737,866	79,152	3,462,837	1942	2,984,503	[3] 1,568,162	266,273	4,818,938
1937	3,179,588	942,158	139,670	4,261,416	1943	3,274,266	[3] 1,868,407	227,294	5,369,967
1938	2,722,927	[2 3] 999,551	137,998	3,860,476	1944	3,486,482	1,413,246	300,274	5,200,002
1939	2,791,360	[3] 1,057,570	139,040	3,987,970	1945	3,814,935	1,260,849	323,955	5,399,739
1940	2,782,956	[3] 1,120,551	164,570	4,068,077					

[1] Includes small quantity of apatite from Virginia.
[2] Includes small quantity of phosphate rock from South Carolina.
[3] Includes some matrix of washer grade.

SALES

A new high record in the quantity of domestic phosphate rock sold or used by producers—5,806,723 long tons—was made in 1945 and exceeded the previous maximum, that of 1944, by 430,080 tons. The total value was over 3 million dollars more than that of 1944, owing partly to the increased sales and partly to a higher average value, which rose from $3.88 in 1944 to $4.12 in 1945.

Phosphate rock sold or used by producers in the United States, 1941–45

Year	Long tons	Value at mines		Year	Long tons	Value at mines	
		Total	Average			Total	Average
1941	4,689,652	$15,596,273	$3.33	1944	5,376,643	$20,856,429	$3.88
1942	4,644,240	16,597,492	3.57	1945	5,806,723	23,951,077	4.12
1943	5,126,232	18,962,021	3.70				

DISTRIBUTION OF SALES

As in 1944, the most popular grades of phosphate rock sold or used by producers in the United States in 1945, according to reports from them, were the 72- and the 75/74-percent B. P. L. grades, although marked increases are to be noted in the 70- and the 68/66-percent B. P. L. grades. Over 72 percent of the domestic phosphate rock sold or used by producers in 1945 was of 70-percent B. P. L. or higher grades. The quantity of phosphate rock containing less than 60 percent B. P. L. sold or used declined in 1945, comprising in that year but 9 percent of the total.

The quantity of domestic phosphate sold or used by producers in the United States for the production of superphosphates is reported to have been nearly 300,000 tons greater in 1945 than in 1944, although its percentage of the total declined slightly. Increases were also registered in the amounts for direct application to the soil and stock and poultry feed. Less is reported to have gone into the chemical uses in 1945 than in 1944. The quantity used for direct application to the soil is now over 400,000 tons a year and forms 7 percent of total uses.

Phosphate rock sold or used by producers in the United States, 1944–45, by grades and uses

	1944			1945		
	Quantity		Value	Quantity		Value
	Long tons	Percent of total		Long tons	Percent of total	
Grades—B. P. L.[1] content (percent):						
Below 60	669,228	12	(2)	523,580	9	(2)
60 to 66	210,561	4	(2)	268,253	5	(2)
68 basis, 66 minimum	223,935	4	(2)	447,882	8	(2)
70 minimum	672,218	13	(2)	916,513	16	(2)
72 minimum	1,291,850	24	(2)	1,251,427	21	(2)
75 basis, 74 minimum	1,107,149	21	(2)	1,177,286	20	(2)
77 basis, 76 minimum	883,815	16	(2)	895,814	15	(2)
Above 85 (apatite) / Undistributed[3]	317,887	6	(2)	325,968	6	(2)
	5,376,643	100	$20,856,429	5,806,723	100	$23,951,077
Uses:						
Domestic:						
Superphosphates	3,681,274	69	(2)	3,945,009	68	(2)
Phosphates, phosphoric acid, phosphorus, ferrophosphorus	890,633	17	(2)	816,843	14	(2)
Direct application to soil	256,736	5	(2)	411,543	7	(2)
Fertilizer filler	19,008	(4)	(2)	14,493	(4)	(2)
Stock and poultry feed	55,944	1	(2)	63,525	1	(2)
Undistributed[5]	27,932	(4)	(2)	65,744	1	(2)
Exports[6]	445,116	8	(2)	489,566	9	(2)
	5,376,643	100	20,856,429	5,806,723	100	23,951,077

[1] Bone phosphate of lime.
[2] Figures not available.
[3] Includes numerous grades of B. P. L. content from 65.9 to 85 percent.
[4] 0.5 percent or less.
[5] Includes phosphate rock used in pig-iron blast furnaces, parting compounds, research, defluorinated phosphate fertilizers, refractories, and other uses.
[6] As reported to Bureau of Mines by domestic producers.

CONSUMPTION

An increase of about 400,000 tons in the apparent domestic consumption of phosphate rock in the United States in 1945 extended the war-time expansion of the domestic demand for that commodity. As indicated on the curve (see fig. 2) the consumption was far above the normal prewar figure and widened still further the great, abnormal, upward fluctuation across the general growth line.

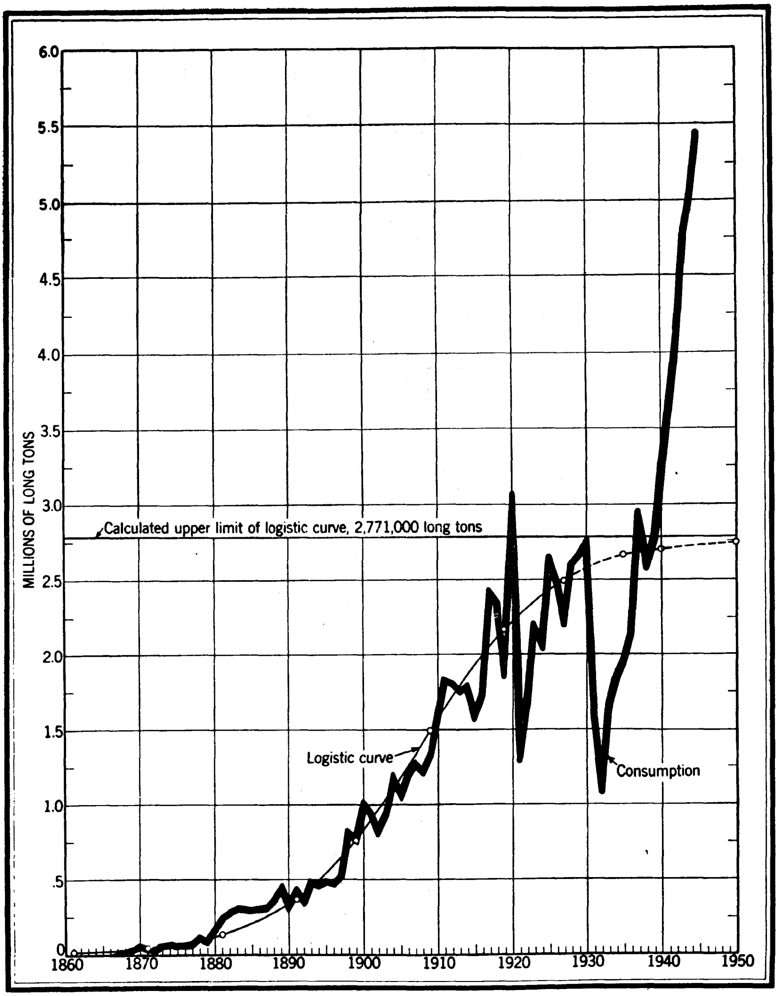

FIGURE 2.—Consumption of phosphate rock in the United States, 1867–1945.

PRICES

Maximum prices of Florida land-pebble phosphate rock, Florida hard-rock phosphate, and Tennessee brown-rock phosphate for sales by miners are covered by Revised Maximum Price Regulation 240 of July 1, 1944, effective July 6, 1944, and the later amendments. No changes were made in unground Florida land-pebble or hard-rock prices during 1945, but in February 1945 (amendment 1) and again in October 1945 (amendment 4) price ceilings for unground Tennessee brown-rock phosphate were raised. The latter increase, effective October 15, 1945, amounts to the approximate cost to the industry of an increase in wages for labor engaged in mining and processing Tennessee phosphate rock. The wage increase was ordered by the War Labor Board and is the amount considered the minimum requirement to keep all essential producers in operation. Manufacturers will be required to absorb the increase, and the price of fertilizer to the farmer will not be affected, according to the Office of Price Administration. These various prices are shown in the accompanying table.

Ceiling prices per long ton of Florida and Tennessee unground phosphate rock, f. o. b cars at mines, by grades, in 1945 [1]

Grades—B. P. L.[2] content (percent)	Prices				
	Florida		Tennessee		
			Brown rock		
	Land pebble	Hard rock	Jan. 1–Feb. 16	Feb. 17–Oct. 14	Oct. 15–Dec. 31
68/66	$2.20		$4.50	$4.60	$4.80
70/68	2.60		5.00	5.10	5.30
72/70	3.20	$7.10	5.50	5.60	5.80
75/74	4.20	7.85			
77/76	5.20	8.60			

[1] Office of Price Administration Revised Maximum Price Regulation 240 and amendments.
[2] Bone phosphate of lime.

Sales of Western States phosphate rock are under the general maximum price regulation at individual ceilings.[2] The Anaconda Copper Mining Co. has established ceiling prices for Idaho phosphate rock, basis f. o. b. cars at Conda, Idaho, guaranteed average 32 percent P_2O_5 (about 70 percent B. P. L.) with no adjustment for grade, as follows:

Sales to superphosphate manufacturers

	Per net ton
Mine-run bulk	$4.75
Crushed undried bulk	5.00
Crushed and dried bulk	5.25
Pulverized bulk	5.90

Sales to fertilizer mixers and dealers

Pulverized bulk	$6.75
Pulverized, in 100-lb. bags	9.25

Sales to consumers

Pulverized bulk	$7.75
Pulverized in 100-lb. bags	10.25

It is reported that the Mountain Copper Co., Ltd., has established the same prices.

[2] C. C. Gran (head, Agricultural Chemicals Section, Food Price Division, Office of Price Administration), Letter, Apr. 22, 1946.

The International Minerals & Chemical Corp. has established maximum prices for Montana phosphate rock, basis f. o. b. cars at Drummond or Hall, Mont., as follows:

Sales to fertilizer manufacturers

Mine run undried.—

$5.75 per net ton, basis 70 percent B. P. L., with 10 cents per unit rise and fall.

Milled and dried, 72/70 percent B. P. L.—

$6.50 per net ton, basis 72 percent B. P. L., with 10 cents per unit rise to 74 percent maximum and fall to 70 percent minimum.

Milled and dried, 75/74 percent B. P. L.—

$7 per net ton, basis 75 percent B. P. L., with 15 cents per unit rise to 76 percent maximum and fall to 74 percent minimum.

Milled and dried, 77/76 percent B. P. L.—

$7.50 per net ton, basis 77 percent B. P. L., with 20 cents per unit rise and fall to 76 percent minimum.

REVIEW BY STATES

Florida.—A new record for the total quantity of Florida phosphate rock sold or used in any one year—4,238,228 long tons, 485,433 tons greater than in 1944—was set in 1945. (See fig. 3.) The total value of this rock, $16,298,474, was nearly 3 million dollars greater than that of the phosphate rock sold or used in 1944 but was still much below the record value of 1920 ($19,464,362). Increases in the quantities sold or used and the values of all the component types of Florida rock—hard rock, land pebble, and soft rock—were recorded in 1945 over 1944. The total average value per ton and the average values for hard rock and land pebble were higher in 1945 than 1944, but the average value per ton of soft rock, as reported by the producers, was less in 1945 than in the preceding year.

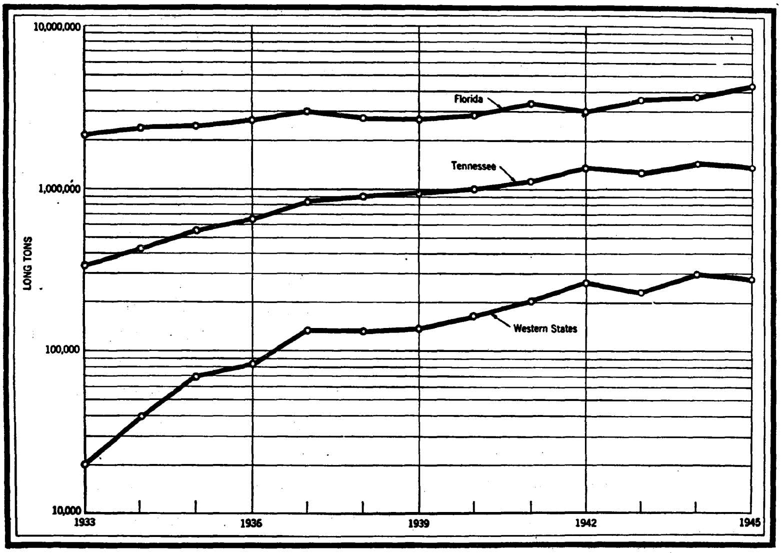

FIGURE 3.—Rate of growth of phosphate rock sold or used by producers, 1933–45, by States.

Three companies were operating in the hard-rock phosphate field in 1945, although mining was being carried on only at the Section 12 mine, operated jointly by C. & J. Camp, Inc. (P. O. Box 608, Ocala, Fla.), and J. Buttgenbach & Co. (P. O. Box 67, Lakeland, Fla.), about 3 miles southeast of Dunnellon. The other company, the Dunnellon Phosphate Mining Co. (P. O. Box 157, Savannah, Ga.) did not operate its mine in Citrus County, near Hernando, which it reports is shut down for an indefinite period, but made some shipments from stock for export. At the Section 12 mine the overburden is removed by hydraulicking, and the underlying phosphate matrix is then mined with a 3-cubic-yard Monighan dragline, which loads it into a 7-cubic-yard skip car for delivery to the washing plant. Later it is expected that an electric shovel will be used for digging the matrix and loading it into Koering Dumptors for hauling to the skip cars. That part of the deposit which is below water level will be mined with a dragline. Detailed descriptions of the plant by Felton [3] and Avery [4] were published during the year.

During the fiscal year ended June 30, 1945, the Federal Trade Commission completed its investigation of the Florida Hard Rock Phosphate Export Association, which it had ordered in 1944 under the Webb-Pomerene law (Export Trade Act), and issued recommendations for readjustment of the business of the association. These recommendations, listed in detail in the annual report of the Commission,[5] are to the effect that the association should withdraw from and rescind certain cartel agreements with foreign producers and with the Phosphate Export Association and other agreements with domestic hard-rock-phosphate producers restricting the use of the Fernandina terminal at Fernandina, Fla., because these divers agreements have been found to have a tendency to restrain trade within the United States.

The investigation of the Phosphate Export Association by the Federal Trade Commission, instituted in August 1944 under the provisions of the Export Trade Act (Webb-Pomerene law), was completed early in 1946, and its recommendations to the Phosphate Export Association were released March 12, 1946.[6] The Commission recommended to the Phosphate Export Association that it withdraw from and rescind certain cartel agreements with foreign producers of phosphate rock requiring it to be responsible in its quotas for all exports from this country, including those of nonmembers. This provision was found by the Commission to be in restraint of the export trade of domestic competitors or potential competitors. The Federal Trade Commission also recommended that the Phosphate Export Association cease the following: (1) Deterring or preventing importation of phosphate rock into the United States; (2) restricting the right of members to withdraw from the association by requiring that their

[3] Felton, T. D., Centralized Washing for Hard-Rock Phosphate: Eng. and Min. Jour., vol. 146, No. 5, May 1945, pp. 81-85.

[4] Avery, W. M., Florida's Only Hard-Rock Phosphate Plant in Operation near Dunnellon: Pit and Quarry, vol. 38. No. 1, July 1945, pp. 84-85, 87.

[5] Federal Trade Commission, Annual Report for the Fiscal Year Ended June 30, 1945: 116 pp. (See pp. 3, 79-80.)

[6] Federal Trade Commission, FTC Makes Recommendations for Readjustment of Business of Phosphate Export Association: Press Release, Mar. 12, 1946, 3 pp.

Federal Trade Commission, United States of America Before Federal Trade Commission; Docket 202-3, In the Matter of Phosphate Export Association et al. Conclusions. [Contains the Commission's conclusions on which its recommendations to the association are based.]

export trade continue to be handled by the association; (3) requiring members who dispose of mineral deposits to arrange for the successor to continue agreements with the association; (4) restricting the licensing of patents to association members; and (5) restricting the use of the Fernandina terminal, Fernandina, Fla., through an agreement with the Florida Hard Rock Phosphate Association.

On October 12, 1945, the Phosphate Export Association announced its dissolution on October 11, 1945, and stated that each of the following member companies would thereafter conduct its own export business in phosphate rock—The American Agricultural Chemical Co., American Cyanamid Co., Coronet Phosphate Co., International Minerals & Chemical Corp., The Phosphate Mining Co., Southern Phosphate Corp., and Swift & Co.

Seven companies were mining and shipping land-pebble phosphate rock in 1945. These were the American Cyanamid Co. (Brewster), American Agricultural Chemical Co. (Pierce), Coronet Phosphate Co. (Plant City), International Minerals & Chemical Corp. (Mulberry), Phosphate Mining Co. (Nichols), Southern Phosphate Co. (Ridgewood), and Swift & Co. Fertilizer Works (Agricola). The Pembroke Chemical Corp. (Pembroke, Fla.) did not mine any land pebble in 1945 but did dry material from its wet-rock stocks, which it exported with previously dried rock. The Virginia-Carolina Chemical Corp. purchased, as of June 1, 1945, practically all the capital stock of the Phosphate Mining Co. The New York office of the latter company was discontinued, and the head office moved to Richmond, Va., to the executive offices of the new parent corporation.

The entire capital stock (2,000 shares of preferred and 2,000 shares of common) of the Ore & Chemical Corp., of New York, owner of 355 shares of the Pembroke Chemical Corp. or 39.44 percent of the 900 issued and outstanding shares, was vested by the Alien Property Custodian under and by virtue of Vesting Order 2587, executed on November 17, 1943, and Supplemental Vesting Order 4818, executed on April 14, 1945, under the authority of the Trading With the Enemy Act, as amended, and Executive Order 9095, Metalgesellschaft, A. G., Frankfurt, Germany, being indicated to have held directly or indirectly a dominant interest in the Ore & Chemical Corp. All the shares of the Ore & Chemical Corp. were sold in 1945 to B. R. Armour, Englewood, N. J. Thirty-five additional shares of the Pembroke Chemical Corp. (3.89 percent of the outstanding capital stock) were vested by the Alien Property Custodian under and by virtue of Vesting Order 4159, executed on September 22, 1944, under the authority of the Trading With the Enemy Act, as amended, and Executive Order 9095, as amended. These shares were sold to the Ore & Chemical Corp. early in 1946.

The Victor Chemical Works, already a large producer of elemental phosphorus in the Tennessee brown-rock-phosphate field, has announced expansion of its elemental phosphorus-producing facilities by the proposed erection of a new electric furnace plant on tidewater on Anclote River, near Tarpon Springs, northwest of Tampa, Fla.. Phosphate rock from the land-pebble field will be used as the source of the phosphorus.

Some of the recent developments in the land-pebble field were described by Barr [7] in a review of the phosphate-rock industry in 1945. He also states that no new mining methods were introduced in this field during the year, although excavation of matrix by electric dragline before hydraulic transport to the washer plant continued to gain favor. Flotation is reported to continue as the dominant factor in the field, and Barr states that most of the deposits left or now being mined could not be practically operated without this process.

Florida phosphate rock sold or used by producers, 1941–45, by kinds

Year	Hard rock			Soft rock [1]		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1941	38,116	$211,049	$5.54	47,750	$132,472	$2.77
1942	70,014	396,527	5.66	48,470	155,345	3.20
1943	34,128	201,241	5.90	71,171	254,995	3.58
1944	22,500	138,952	6.18	60,087	259,523	4.32
1945	63,491	426,061	6.71	71,715	293,433	4.09

Year	Land pebble			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1941	3,279,706	$9,890,510	$3.02	3,365,572	$10,234,031	$3.04
1942	2,893,756	8,826,705	3.05	3,012,240	9,378,577	3.11
1943	3,483,194	11,633,241	3.34	3,588,493	12,089,477	3.37
1944	3,670,208	13,136,472	3.58	3,752,795	13,534,947	3.61
1945	4,103,022	15,578,980	3.80	4,238,228	16,298,474	3.85

[1] Includes material from waste-pond operations.

Tennessee.—The tonnage of phosphate rock sold or used by Tennessee producers in 1945 (plus a small quantity of apatite from Virginia) was about 30,000 tons less than in 1944, according to reports from the producing companies. The phosphate rock sold or used was brown rock, except for the Virginia apatite, and a small tonnage of Tennessee blue rock. Although the tonnage sold or used decreased in 1945, the total value was greater than in 1944, the average value increasing from $4.51 in 1944 to $4.68 in 1945.

Tennessee brown-rock phosphate was mined in 1945 by the Tennessee Valley Authority (Columbia, Tenn.) and by several private companies: Armour Fertilizer Works (Room 350, Hurt Building, Atlanta, Ga.), Federal Chemical Co. (634 Starks Building, Louisville, Ky.), Harsh Phosphate Co. (Route 4, Murfreesboro Road, Nashville, Tenn.), Hoover & Mason Phosphate Co. (8 South Michigan Avenue, Chicago, Ill.), International Minerals & Chemical Corp. (20 North Wacker Drive, Chicago, Ill.), Monsanto Chemical Co. (1700 South Second Street, St. Louis, Mo.), and Virginia-Carolina Chemical Corp. (Richmond, Va.). Sales of blue rock are reported to have been made by George E. Sloan, Columbia, Tenn.

Barr [8] states that there were no new mine or plant installations in

[7] Barr, J. A., Potash and Phosphate: Min. Cong. Jour., vol. 32, No. 2, February 1946, pp. 69–72.
[8] Barr, J. A., Work cited in footnote 7.

the Tennessee phosphate fields in 1945, although some old equipment was replaced by new and more modern types, such as Diesel machines for the old steam dragline excavators. The nominal grade of phosphate rock for electric-furnace consumption is given as 55 percent B. P. L. while that for the manufacture of superphosphate is said to average 70 percent B. P. L.

The series of articles on the treatment of phosphate rock by Wustrack, begun in 1944, was continued by the appearance of the fifth article—on sampling and analysis.[9]

A brief summary of the Tennessee phosphate-rock deposits and industry appeared in 1945 in a report of the Tennessee State Planning Commission.[10]

According to the annual published report of the Tennessee Valley Authority for the fiscal year ended June 30, 1945, approximately 517,000 tons of phosphate matrix was mined during the year. More than 525,000 tons of matrix, containing 20.6 percent P_2O_5, were processed in the Godwin washing plant, and about 242,000 tons of phosphate sands, averaging 26.2 percent P_2O_5, were recovered. This was nearly 20 percent more than the total of washed sands produced in 1944. Nearly 60,000 tons of lump sinter were produced and shipped to Muscle Shoals, together with over 7,300 tons of sinter fines, which were reprocessed in the nodulizing kilns at Muscle Shoals. Purchases of phosphatic materials, comprising sinter from the Monsanto Chemical Co. and washed sands from the International Minerals & Chemical Corp., declined to 121,000 tons or about 79 percent of 1944 purchases, as a result of the increase in field plant operations of TVA. Additional phosphate reserves were acquired during the year through the purchase in fee simple of three tracts in Williamson County, Tenn., containing an estimated 1,309,000 tons of matrix, and purchase of the mineral rights on another tract in Maury County, estimated to contain about 323,000 tons.

Total production of elemental phosphorus for the fiscal year reached 29,800 tons as compared with 24,400 tons in the 1944 fiscal year. More than four-fifths of this output—about 24,000 tons—was shipped to satisfy requests of the Chemical Warfare Service. Only about 4,000 tons of elemental phosphorus were available for use in manufacturing concentrated phosphatic fertilizers, chiefly during the latter part of the year. The increased production of elemental phosphorus was achieved despite major repairs and construction involving all five electric furnaces. This included replacement of one of the units, previously constructed to produce phosphoric acid direct, with an enlarged furnace producing elemental phosphorus. A second furnace was dismantled because of obsolescence and deterioration and was replaced with a larger unit. Major repairs were made to the crucibles of the other three furnaces. Construction of a 13,000-kilowatt phosphorus furnace was begun during the year at the request of WPB and was half-completed at the close of the year.

A small experimental plant for the production of red phosphorus suitable for small arms primer compositions was operated during the year, and 3,800 pounds of primer-grade material were sent to the

[9] Wustrack, O. H., Phosphate Production Problems; Article 5. Sampling and Analysis: Rock Products, vol. 48, No. 4, April 1945, pp. 71,138, 140, 142.

[10] Whitlatch, G. I. (compiler), Industrial Resources of Tennessee: Tennessee State Planning Commission, Nashville, Tenn., 1945, 210 pp. (See pp. 35–37.)

Frankford Arsenal. Forty 4.2-inch mortar shells were filled with mixtures of red and white phosphorus for testing by the Chemical Warfare Service. A laboratory study was also carried out on metallic phosphides to determine their possible usefulness in incendiary bullets.

About 22,400 tons of concentrated superphosphate were produced during the year, about half as much as during the previous year. The production of calcium metaphosphate was a little over 4,000 tons, but shipments totaled about 6,000 tons. Production of this material was about 42 percent above that of the 1944 fiscal year. Construction of the new fused tricalcium phosphate plant at Godwin, Tenn., was completed, and one of the two furnace units was placed in operation late in May. The plant has a designed capacity of 120 tons a day of fertilizer-grade material or 70 tons of feed-grade material. Production up to June 30, 1945, was 1,050 tons of fertilizer-grade, fused tricalcium phosphate.

Over 6,400 tons of feed-grade dicalcium phosphate were produced for use as animal feed supplements in the absence of importations of bonemeal during the war. Production was started in the previous fiscal year at the request of the War Food Administration and as authorized by the War Production Board. Largely because of the demand for elemental phosphorus for military use, 1945 production was only about 72 percent of that of the previous year.

With the large wartime expansion in phosphorus capacity, the limiting factor in fertilizer production was in the acid plant, where owing to deterioration during the year one unit became inoperable. A new improved unit was placed in operation, and plans were completed for the construction of two new units, each capable of burning 24 tons of phosphorus per day. One of these is an entirely new experimental installation for producing superphosphoric acid.

In small-scale tests, diammonium phosphate was produced, containing a high concentration of plant food. Experimental work resulted in development of a continuous process which was under test at the end of the year.

About 612 tons of TVA triple-superphosphate were sold commercially for the first time through Associated Cooperatives. The sales were made at wholesale ceiling prices to several Mississippi Valley cooperatives.

Tennessee phosphate rock (including sintered matrix) sold or used by producers, 1941–45

[Includes apatite from Virginia]

Year	Long tons	Value at mines: Total	Value at mines: Average	Year	Long tons	Value at mines: Total	Value at mines: Average
1941	1,120,358	$4,590,965	$4.10	1944 [1]	1,324,849	$5,975,337	$4.51
1942 [1]	1,366,335	6,127,792	4.48	1945 [1]	1,294,297	6,062,688	4.68
1943 [1]	1,309,059	5,822,249	4.45				

[1] Includes small quantity of blue rock.

Virginia.—In 1945 apatite was produced from the Piney River nelsonite deposit by the Calco Chemical Division of the American Cyanamid Co. The company became a shipper in February 1945 after the superphosphate plant was shut down and dismantled.

The drill sampling is described and evaluation of this Piney River ilmenite-apatite lode in 1944 is given by Davidson in a paper published early in 1946.[11] The ore body is the upper weathered part of a tabular mass of a basic rock (a mixture of feldspar, ilmenite, and apatite) occurring in a large area of pre-Cambrian granite-gneiss. The ore-bearing section is about 3,000 feet long, strikes northeasterly, and has an average dip of 45° SE. The weathered outcrop of the ore body is now being exploited by open-cut.

Western States.—A new high record for the value of the marketed production of phosphate rock featured the Western States phosphate-rock industry in 1945, when the total value of that sold or used exceeded 1½ million dollars ($1,589,915). This, an increase of 18 percent over the 1944 figure, reflects a higher average value per ton of rock. The tonnage marketed, however (274,198 long tons with a P_2O_5 content of 88,052 tons), was less in 1945 than in 1944 when 298,999 tons, containing 95,767 tons P_2O_5, were sold or used. This was a decrease of 8 percent from the record high of the previous year, but it still remained greater than for any other year. The production in 1945 came from Idaho and Montana; only development work was reported in Wyoming, and Utah remained inactive. The average P_2O_5 content of the Western States phosphate rock sold or used in 1945 is reported to have been 32.11 percent, a little above that of 1944 (32.03 percent).

Montana continued to be the largest phosphate-rock producer of the Western States group in 1945 as in other recent years; its lead over Idaho, however, dropped to only 27,518 long tons. (See fig. 4.) Its total in 1945 (150,858 long tons, with a P_2O_5 content of 49,068 tons) was a decrease of 19 percent from 1944. The average P_2O_5 content was 32.53 percent, slightly higher than that of 1944 (32.16 percent). The Montana Phosphate Products Co., of Trail, British Columbia, still the largest producer in the Western States in 1945, in spite of a marked decrease in production in 1945, operated its Anderson, Anaconda, and Graveley mines as well as several Government leases. Most of the mined product was exported to the plant of the Consolidated Mining & Smelting Co., of Canada, Ltd., at Trail, but a considerable quantity was sold in the United States. Gilbert's description [12] of the operations of this company was published early in 1945. The International Minerals & Chemical Corp. operated its property in the Douglas Creek area, Granite County, during the early months of 1945. Considerable phosphate rock was mined. The crude ore was taken to its concentrating plant at Sherryl on the Phillipsburg branch of the Northern Pacific Railway, and the concentrates produced were shipped. Lee H. Skeels, trustee for and leasee of the Soluble Phosphates, Ltd., Maxville, Granite County, Mont., mined a small tonnage at the Master Key mine near Maxville in 1945, ground, and shipped the product for direct application to the soil. Tests on phosphate rock from this property for radioactivity and uranium minerals with a Geiger-Muller counter at the Bureau of Mines laboratory, College Park, Md., in 1945, did not show the presence of either.

[11] Davidson, D. M., Diamond-Drill Sludge Sampling and Appraisal of a Weathered Ilmenite Ore Body, Piney River, Va.: Am. Inst. Min. and Met. Eng., Tech. Pub. 1951, Min. Technol., vol. 10, No. 1, January 1946, 5 pp.

[12] Gilbert, Geoffrey, Mining Operations of the Montana Phosphate Products Co.: Am. Inst. Min. and Met. Eng. Tech. Pub. 1824, Min. Technol., vol. 9, No. 3, May 1945, 5 pp.

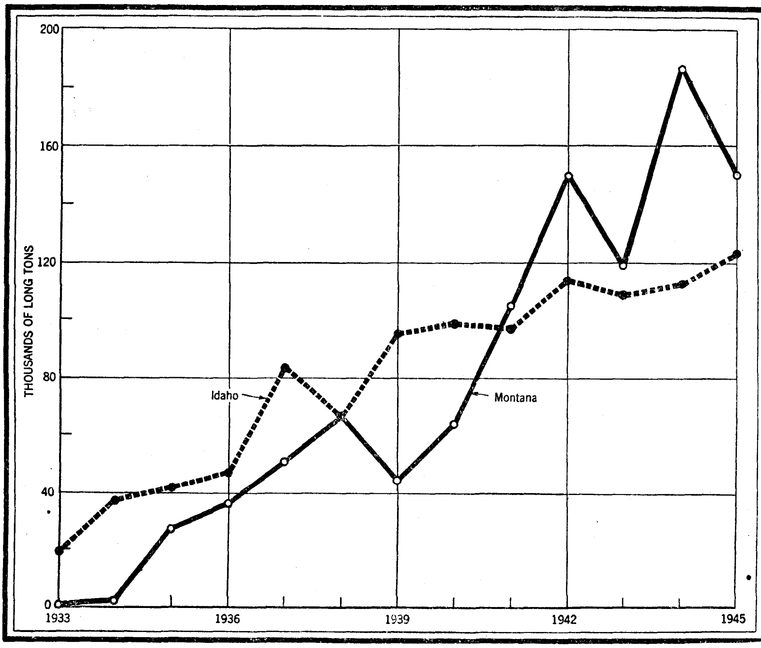

FIGURE 4.—Idaho and Montana phosphate rock sold or used by producers, 1933–45.

A record marketed production of Idaho phosphate rock was made in 1945 (123,340 long tons containing 38,984 tons P_2O_5 content). This was an increase of 8 percent over the previous record made in 1942 (114,079 tons). The average P_2O_5 content was 31.61 percent, a little below that of 1944 (31.80 percent). There were three phosphate-rock-producing companies in Idaho in 1945. By far the largest of these, the Anaconda Copper Mining Co., operated its No. 3 mine at Conda, Caribou County. Most of the shipments in 1945, as in prior years, went to the company plant at Anaconda, Mont., for conversion to superphosphate and phosphate chemicals. A considerable quantity was sold to other domestic consumers. The San Francisco Chemical Co., 216 Pine Street, San Francisco 4, Calif., started operations again at its Waterloo mine near Montpelier, Bear Lake County, Idaho, during 1945, and mined a sizable quantity, part of which was sold for the manufacture of superphosphate and the remainder retained in stock. The Teton Phosphate Co., Montpelier, Idaho, mined phosphate rock from its Bennington mine near Bennington, Bear Lake County, Idaho. This was ground in the company plant and sold for direct application to the soil.

No phosphate rock was produced in either Utah or Wyoming in 1945. The Garfield Chemical & Manufacturing Corp., Salt Lake City, Utah, which mined and shipped phosphate rock in 1942 from a Federal lease near Spanish Fork, Utah County, Utah, made no production in 1943, 1944, or 1945. John M. Thomas reported only development work at his property near Cokeville, Lincoln County, Wyo.

The average value per ton of the Western States phosphate rock sold or used, as reported by the producers to the Bureau of Mines, increased sharply in 1945—$1.30 per ton—or from $4.50 in 1944 to $5.80 per ton in 1945. There was an increase of only 27 cents per ton in Idaho, but one of $1.98 in Montana.

Papers by Gale [13] and the Mining World [14] describing the recovery of lithium phosphate from the brines of Searles Lake, Calif., appeared during the year.

Western States phosphate rock sold or used by producers, 1941–45

Year	Idaho			Montana		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1941	97,274	$444,154	$4.57	105,108	$318,588	$3.03
1942	114,079	511,249	4.48	150,402	572,464	3.81
1943	108,916	561,630	5.16	119,764	488,665	4.08
1944	112,565	584,400	5.19	186,434	761,745	4.09
1945	123,340	673,627	5.46	150,858	916,288	6.07

Year	Utah			Total		
	Long tons	Value at mines		Long tons	Value at mines	
		Total	Average		Total	Average
1941	1,340	$8,535	$6.37	203,722	$771,277	$3.79
1942	1,184	7,410	6.26	265,665	1,091,123	4.11
1943				228,680	1,050,295	4.59
1944				298,999	1,346,145	4.50
1945				274,198	1,589,915	5.80

FOREIGN TRADE

Data on imports and exports of phosphate rock are shown in the following tables:

Phosphate rock and phosphatic fertilizers imported for consumption in the United States, 1941–45

Fertilizer	1941		1942		1943		1944		1945	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Apatite			179	$1,025	6,114	$61,890	6,090	$52,758	12,804	$102,435
Phosphates, crude, not elsewhere specified	4,340	$32,816	3,586	23,862	40,391	315,268	117,324	952,374	128,854	1,010,091
Ammonium phosphates, used as fertilizer	55,430	2,483,756	25,521	1,150,319	39,274	1,827,294	82,092	3,942,544	82,819	3,993,116
Bone dust, or animal carbon and bone ash, fit only for fertilizing	27,607	622,731	7,855	213,970	573	24,244	14,785	476,802	8,455	299,780
Guano	15,394	460,370	3,128	159,799	8,591	526,173	4,365	278,857	2,762	186,804
Slag, basic, ground or unground			1	10	3	56				
Precipitated bone, fertilizer grade			23	851	75	2,730				

[13] Gale, W. A., Lithium from Searles Lake: Chem. Ind., vol. 57, 1945, pp. 442–446.

[14] Mining World, Lithium-Salt Recovery in American Potash's Soda Product Plant: Vol. 7, No. 10, 1945, pp. 25–28.

Phosphate rock [1] exported from the United States, 1941–45

Year	Long tons	Value	Year	Long tons	Value
1941	1,019,960	$5,738,859	1944	438,133	$3,460,916
1942	528,716	3,348,341	1945 [2]	383,904	3,081,145
1943	358,010	2,871,136			

[1] 1941–45: Excludes "Phosphate rock: Florida: Other (including soft rock, colloidal and sintered matrix)," which is included under "Other phosphate materials."
[2] 1945 figures subject to revision.

Phosphate rock [1] exported from the United States, 1941–45, by countries

HIGH-GRADE HARD ROCK

Country	1941		1942		1943		1944		1945 [2]	
	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value	Long tons	Value
Australia	---	---	---	---	---	---	3,997	$21,983	18,274	$134,432
Belgium and Luxembourg	---	---	---	---	---	---	---	---	21,000	175,750
Brazil	201	$3,500	---	---	---	---	---	---	---	---
Canada	110,658	667,324	157,318	$969,111	102,759	$596,457	183,828	989,559	137,957	750,775
Sweden	---	---	---	---	---	---	---	---	14,150	120,275
United Kingdom	45,754	285,062	80,273	497,080	42,815	272,547	17,914	121,400	4,500	29,250
	156,613	955,886	237,591	1,466,191	145,574	869,004	205,739	1,132,942	195,881	1,210,482

LAND PEBBLE

Country	1941 Long tons	1941 Value	1942 Long tons	1942 Value	1943 Long tons	1943 Value	1944 Long tons	1944 Value	1945 [2] Long tons	1945 [2] Value
Australia	---	---	---	---	24,457	$128,628	27,011	$163,983	18,284	$107,650
Canada	103,827	$800,951	97,951	$909,986	129,913	1,522,182	166,050	1,926,142	132,105	1,499,678
Eire	---	---	6,697	46,879	18,204	137,336	5,447	47,280	---	---
Japan	72,722	274,981	---	---	---	---	---	---	---	---
Liberia	28	288	---	---	---	---	---	---	---	---
Mexico	---	---	---	---	---	---	---	---	51	620
Netherlands	---	---	---	---	---	---	---	---	148	888
New Zealand	---	---	---	---	13,248	72,864	33,886	190,569	22,923	178,981
Portugal	32,490	187,866	---	---	---	---	---	---	---	---
Sweden	---	---	---	---	---	---	---	---	5,200	44,200
Union of South Africa	55,345	314,658	3,299	18,969	---	---	---	---	---	---
United Kingdom	598,935	3,204,229	183,178	906,316	26,614	141,122	---	---	9,312	38,646
	863,347	4,782,973	291,125	1,882,150	212,436	2,002,132	232,394	2,327,974	188,023	1,870,663

[1] 1941–45: Excludes "Phosphate rock: Florida: Other (including soft rock, colloidal and sintered matrix)," which is included under "Other phosphate materials."
[2] 1945 figures subject to revision.

High-grade hard-rock phosphate [1] exported from the United States, 1944–45, by customs districts

Customs district	1944		1945 [2]	
	Long tons	Value	Long tons	Value
Dakota	25	$1,155	30	$1,080
Florida	21,911	143,383	57,924	459,707
Michigan	359	2,990	104	566
Montana and Idaho	183,112	981,487	137,775	748,479
St. Lawrence	49	575	---	---
Washington	283	3,352	48	650
	205,739	1,132,942	195,881	1,210,482

[1] Includes Florida high-grade hard rock and Tennessee, Idaho, and Montana phosphate rock.
[2] 1945 figures subject to revision.

Other phosphate materials [1] exported from the United States, 1941–45

Year	Long tons	Value	Year	Long tons	Value
1941	22,988	$262,045	1944	1,677	$78,789
1942	5,257	292,934	1945 [2]	111,419	842,126
1943	862	94,391			

[1] Includes bone ash, dust, and meal; animal carbon for fertilizer; basic slag; sintered matrix, etc.
[2] 1945 figures subject to revision.

WORLD PRODUCTION

The following table gives available figures on production of phosphate rock in various countries in recent years:

World production of phosphate rock, 1939–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1939	1940	1941	1942	1943	1944	1945
Algeria	499,920	370,890	446,535	331,428	76,798	220,349	(2)
Australia:							
New South Wales	17	20	31	118	29	----------	(2)
South Australia	----------	254	8,597	14,182	12,976	(2)	(2)
Western Australia	----------	39	21	----------	43	2,251	(2)
Brazil (apatite)	(3)	(3)	(2)	(2)	6,111	5,216	(2)
Canada	142	325	2,256	1,147	1,316	437	267
Chile (apatite)	9,014	32,000	29,123	24,909	37,924	50,840	(2)
China	[4] 8,000	(3)	(2)	(2)	(2)	(2)	(2)
Christmas Island, Straits Settlements (exports)	177,972	241,826	(2)	(2)	(2)	(2)	(2)
Egypt	547,538	183,464	111,708	328,440	315,566	318,185	(2)
Eire	(3)	(3)	(2)	16,444	17,252	20,300	(2)
French Oceania (exports)	(3)	(3)	192,237	175,066	188,386	[4] 200,000	(2)
Makatea Is. (exports)	160,680	173,177	(2)	(2)	(2)	(2)	(2)
Germany:							
Bavaria	283	(3)	(2)	(2)	(2)	(2)	(2)
Prussia and Saar	1,240	1,548	1,043	829	(2)	(2)	(2)
India, British	185	119	81	337	1,215	(2)	(2)
Indochina	35,694	24,388	(2)	(2)	(2)	(2)	(2)
Madagascar	7,250	495	(2)	(2)	(2)	(2)	(2)
Morocco, French	1,702,973	731,971	511,537	728,923	815,898	1,444,902	1,635,000
Nauru and Ocean Islands [5]	1,244,170	1,263,385	(2)	(2)	(2)	(2)	(2)
Netherlands Indies	18,777	34,085	(2)	(2)	(2)	(2)	(2)
Netherlands West Indies:							
Curaçao (exports)	64,072	6,047	111,995	(2)	(2)	(2)	8,770
New Zealand	----------	----------	----------	----------	9,389	20,251	(2)
Palestine	(3)	(3)	2	2,818	5,384	5,735	(2)
Seychelles Islands (exports)	23,545	14,613	(2)	(2)	(2)	(2)	(2)
South-West Africa	----------	869	(2)	59	164	----------	(2)
Spain	10,320	15,781	13,846	15,232	15,722	17,770	[4] 19,000
Sweden (apatite)	6,267	(3)	(2)	(2)	[4] 150,000	[4] 150,000	(2)
Tanganyika Territory	132	9	33	25	269	(2)	(2)
Tunisia	1,627,912	1,187,823	1,076,118	879,743	334,678	522,265	706,340
U. S. S. R. (apatite)	1,618,000	(3)	[4] 2,000,000	(2)	(2)	(2)	(2)
United States (sold or used by producers)	3,817,368	4,066,943	4,764,921	4,718,780	5,208,508	5,462,938	5,899,921
World production (estimate)	11,583,000	9,800,000	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed, Angaur Island, Austria, Belgium, Estonia, Formosa (Taiwan), France, Italy, Japan, New Caledonia, Philippine Islands, Poland, and Rumania produce phosphate rock, but data of output are not available.
[2] Data not available.
[3] Estimate included in total.
[4] Estimate.
[5] Exports during fiscal year ended June 30 of year stated.

TECHNOLOGIC DEVELOPMENTS

Listed below are various papers on developments in phosphate-rock technology that have been published in recent months.[15]

SUPERPHOSPHATES

The following tables give the outstanding features of the superphosphates industry in the United States from 1943 to 1945:

Salient statistics of the superphosphate industry in the United States, 1943–45

	1943	1944	1945
Production [1] short tons	6,292,955	6,692,368	7,372,104
Shipments [1] do	3,935,293	3,951,402	4,332,992
Stocks in manufacturers' hand, Dec. 31 [1] do	791,385	794,778	808,027
Exports of superphosphates long tons	239,779	183,828	184,962
Imports of superphosphates do	2,554	1,217	1,773
Sales of phosphate rock by producers for superphosphate production long tons	3,631,786	3,681,274	3,945,009

[1] Bureau of the Census, Monthly Statistics, Superphosphate Industry, 18 percent available phosphoric acid.

Superphosphates (acid phosphates) exported from the United States, 1944–45 by countries

Country	1944		1945	
	Long tons	Value	Long tons	Value
Africa: British East Africa	1,460	$64,831		
Brazil	6,290	109,384	22,396	$467,137
Canada	88,797	1,685,595	63,197	1,036,235
Colombia			4,449	88,954
El Salvador	365	8,365	562	14,861
Greece			7,179	125,915
India and dependencies	2,750	92,048	893	45,000
Netherlands			7,095	289,472
New Zealand	5,241	28,829		
Poland and Danzig			9,464	180,450
United Kingdom	55,373	2,300,148	25,567	1,075,749
Venezuela	98	2,585	58	1,707
West Indies:				
British:				
Bahamas	139	3,848	45	960
Leeward and Windward Islands	120	3,064	515	11,318
Trinidad and Tobago	101	2,143	172	5,376
Other British	521	11,640	50	2,470
Cuba	21,958	538,230	38,667	807,527
Haiti	6	162	1	127
Yugoslavia			3,186	47,456
Other countries	609	16,537	1,466	39,350
	183,828	4,867,409	184,962	4,240,064

[15] Skerrett, J. C., Threshold Treatment of Water: Canadian Chem. and Proc. Ind., vol. 29, No. 4, April 1945, p. 226.
Hatch, G. B., and Riee, Owen, Corrosion Control with Threshold Treatment: Ind. Eng. Chem., ind. ed., vol. 37, No. 8, August 1945, pp. 752–759.
Maas, A. R., Phosphate Philosophy: Chem. and Met. Eng., vol. 52, No. 12, December 1945, pp. 112–114.
Barr, J. A., Machines for Nonmetallic Flotation: Am. Inst. Min. and Met. Eng., Tech. Pub. 1922, Min. Technol., vol. 9, No. 5, September 1945, 11 pp.

Superphosphates (acid phosphates) imported for consumption in the United States, 1943–45, by classes

Classes	1943		1944		1945	
	Long tons	Value	Long tons	Value	Long tons	Value
Normal (standard) (not over 25 percent P_2O_5 content)	252	$4,678	1,212	$24,420	1,701	$30,180
Concentrated (treble) (over 25 percent P_2O_5 content)	2,242	63,515	5	156	72	1,836
Ammoniated	60	3,698				
	2,554	71,891	1,217	24,576	1,773	32,016

Several articles relating to the superphosphates industry appeared in 1945 or early in 1946.[16]

BASIC SLAG

No recent figures for production of basic slag are available for the United States or for any foreign country. None has been imported into the United States since 1943.

[16] Fox, E. J., Hill, W. L., Jacob, K. D., and Reynolds, D. S., Thermal Defluorination of Superphosphate: Ind. Eng. Chem., ind. ed., vol. 38, No. 3, March 1946, pp. 329–334.
Copson, R. L., Concentrated Superphosphate: Chem. and Met. Eng., vol. 52, No. 5, May 1945, pp. 218, 220.
Baylor, H. B., Superphosphate: Its Production and Outlook: Commercial Fertilizer Yearbook 1944, pp. 23–25.
Journal, Association of Official Agricultural Chemists, Nutritive Evaluation of Defluorinated Phosphates and Other Phosphorus Supplements: Vol. 28, No. 1, February 1945, pp. 105–142. Part I. Preparation and Properties of the Samples, by W. L. Hill, D. S. Reynolds, S. B. Hendricks, and K. D. Jacob: Pp. 105–118; Part II. Defluorinated Phosphates as Phosphorus Supplements for Chicks, by H. R. Bird, J. P. Mattingly, H. W. Titus, J. C. Hammond, W. L. Kellogg, T. B. Clark, C. E. Weakley, Jr., and A. H. Van Landingham: Pp. 118–129; Part III. Utilization Experiments with Rats, by N. R. Ellis, C. A. Cabell, W. P. Elmslie, G. S. Fraps, P. H. Phillips, and Dorothy E. Williams: Pp. 129–142.

TALC, PYROPHYLLITE, AND GROUND SOAPSTONE[1]

By Bertrand L. Johnson and Dorothy I. Marsh

SUMMARY OUTLINE

GENERAL CONDITIONS

Mined production of talc, pyrophyllite, and ground soapstone in 1945 continued its decline from the high levels of 1943, according to reports from producers. Sales increased slightly in quantity, but declined in value. (See fig. 1.) Sales of the ground materials were

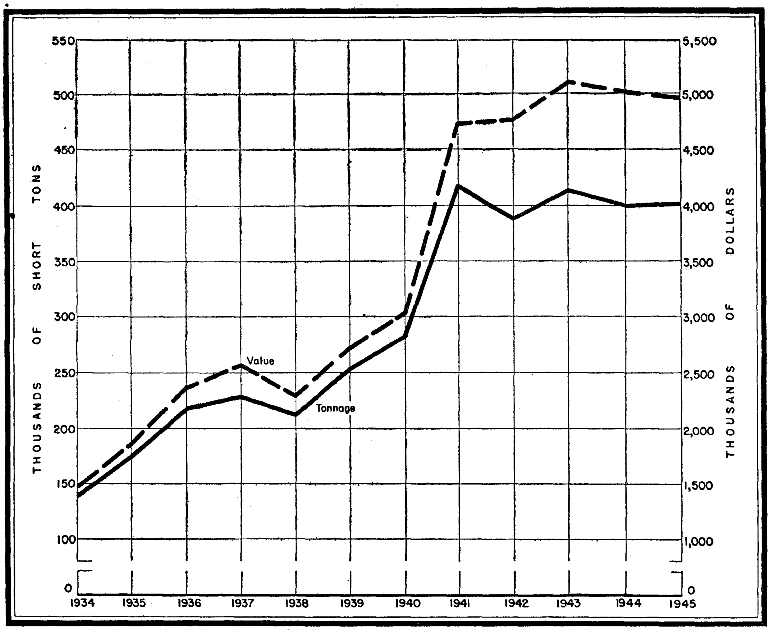

FIGURE 1.—Sales of domestic talc, pyrophyllite, and ground soapstone, 1934–45.

[1] Soapstone sold in slabs or blocks is included in the chapter on Stone.

larger in both quantity and value in 1945 than in 1944. Sales of crude were less in both categories. Total imports in 1945 were less in both quantity and value than in 1944, as were also the imports of all classes of these materials. Exports of "talc, steatite, soapstone, and pyrophyllite, crude and ground" increased in 1945 both in quantity and value. Exports of "powder—talcum (in packages), face, and compact," increased greatly in value.

Production and sales figures of pyrophyllite are now available for 4 years and are given in the footnotes of the salient statistics table. Pyrophyllite is included with talc in this chapter because of its resemblance to talc in certain physical properties and because it is interchangeable with talc in some uses, although certain specialized uses for pyrophyllite have been developed in recent years. It is a hydrous aluminum silicate, whereas talc is a hydrous magnesium silicate.

Salient statistics of the talc, pyrophyllite,[1] and ground-soapstone industries in the United States, 1944–45

	1944		1945	
	Short tons	Value	Short tons	Value
Mined:				
Total	418,228	(2)	401,217	(2)
Used by producers	353,209	(2)	361,749	(2)
Sold by producers:				
Crude	[3] 45,654	[3] $514,476	39,331	$304,719
Sawed and manufactured	938	223,924	2,558	165,446
Ground	352,271	4,279,062	359,191	4,486,736
	398,863	5,017,462	401,080	4,956,901
Imports for consumption: [4]				
Crude and unground steatite and French chalk	696	60,137	385	20,980
Cut and sawed	132	20,639	122	17,618
Ground, washed, or pulverized	7,650	88,207	6,192	63,260
	8,478	168,983	6,699	101,858
Exports:				
Talc, steatite, soapstone, and pyrophyllite, crude and ground	10,709	229,293	11,141	279,178
Powder—talcum (in packages), face, and compact	(5)	1,328,890	(5)	2,276,758
		1,558,183		2,555,936

[1] In 1944: Mined, 67,252 short tons. Sold—crude, 5,683 tons, $52,343; ground, 60,560 tons, $504,739; total, 66,243 tons, $557,082. In 1945: Mined, 77,716 short tons. Sold—crude, 5,949 tons, $33,910; ground and other manufactures, 71,645 tons, $617,290; total, 77,594 tons, $651,200 (exclusive of pinite).
[2] Data not available.
[3] Includes pinite from Nevada.
[4] Exclusive of "Manufactures, n. s. p. f., except toilet preparations," as follows: 1944: $25; 1945: $63. Quantities not available.
[5] Quantity not recorded.

Thirteen States reported sales of talc, pyrophyllite, or ground soapstone in 1945, the same as in 1944. The greater part of the total sales was made by the Eastern States in 1945, and most of the remainder came from the Southwest—southeastern California and southwestern Nevada.

A downward trend in the production of talc reflected in a drop in average inventories to about a 6-week supply prompted the War Production Board to issue, on April 9, 1945, the amended Conservation Order M–239, Talc, effective April 23, 1945. This channeled the critical grades into the most essential war needs, such as paint for the

Army, Navy, Marine Corps, Coast Guard, Maritime Commission, War Shipping Administration, Office of Scientific Research and Development, or the government of any country whose defense the President considered vital to the defense of the United States, or for use in the manufacture of rubber tires, or for the packaging of synthetic rubber. The order was revoked August 20, 1945. (Federal Register, August 21, 1945, p. 10180.)

A series of maps of the Waterbury and Johnson talc mines in Washington and Lamoille Counties, Vt., prepared by the Geological Survey, became available in 1945. The Eastern Magnesia Talc Co. operates both of these mines. The deposits consist of irregular, lenticular bodies in schist. The maps include a surface map of each mine, as well as a geologic map of the 200-foot level and five structure sections of the Johnson mine. A geologic map of the International No. 4 mine and parts of the No. 3 and No. 5 mines, St. Lawrence County, N. Y., prepared by the Geological Survey, also is ready for distribution.

A summary description of talc deposits and industry of New York is included in a study of the mineral industries of the Adirondacks by Otte.[2]

The Palen Mountains talc deposit in eastern Riverside County, Calif., was described by Tucker and Sampson [3] in a report on the mineral resources of Riverside County, and the geology, chemistry, and utility of California talcs has recently been discussed by Lamar.[4]

OUTLOOK

The growth of the talc, pyrophyllite, and ground soapstone industry in evidence in the prewar years was halted during the war at around the 400,000-tons-a-year level. (See fig. 1.) The lessened immediate postwar demand for these commodities, with the decline in the needs for war usages, is expected to be reflected in a smaller domestic production. Some newly developed wartime uses that may find application in a peacetime economy may cushion the expected decline. Moreover, the need for these commodities in paint and roofing materials for postwar building programs may counterbalance the decline in painting and roofing activities by the Army and Navy. Increased demands from the ceramic, rubber, paper, and other industries may later revive the pre-war upward trend in sales.

The importation of high-grade talcs from various European countries as well as from Manchuria and other Asiatic regions is expected to revive. Foreign cosmetic-grade talcs have already returned to the domestic market.

SALES

In 1945 the quantity of domestic talc, pyrophyllite, and ground soapstone sold or used was slightly greater than in 1944, according to reports of the producers to the Bureau of Mines, but was less than in either 1943 or 1941. The total value reported was less than in 1944 or 1943. The average value per ton in 1945 was only $12.36, which was lower than in either 1943 or 1944.

[2] Otte, H. F., The Expanding Mineral Industry of the Adirondacks: New York Dept. of Commerce, Pub. 10, February 1943, reprinted, August 1944, 50 pp. (See pp. 35–37.)

[3] Tucker, W. B., and Sampson, R. J., Mineral Resources of Riverside County: California Jour. Mines and Geol., vol. 41, No. 3, July 1945, pp. 121–182. (See p. 182.)

[4] Lamar, R., Geology, Chemistry, and Utility of California Talcs: Off. Digest, No. 238, 1944, pp. 393–397.

Talc, pyrophyllite,[1] *and ground soapstone sold by producers in the United States, 1941–45, by classes*

Year	Crude: Short tons	Crude: Value at shipping point: Total	Crude: Value at shipping point: Average	Sawed and manufactured: Short tons	Sawed and manufactured: Value at shipping point: Total	Sawed and manufactured: Value at shipping point: Average
1941	[2] 43,823	[2] $393,839	[2] $8.99	4,186	$308,467	$73.69
1942	[2] 33,837	[2] 303,166	[2] 8.96	1,505	370,631	246.27
1943	30,200	289,563	9.59	1,669	316,973	189.92
1944	[2] 45,654	[2] 514,476	[2] 11.27	938	223,924	238.72
1945	39,331	304,719	7.75	2,558	165,446	64.68

Year	Ground: Short tons	Ground: Value at shipping point: Total	Ground: Value at shipping point: Average	Total: Short tons	Total: Value at shipping point: Total	Total: Value at shipping point: Average
1941	368,360	$3,999,586	$10.86	416,369	$4,701,892	$11.29
1942	352,621	4,080,279	11.57	387,963	4,754,076	12.25
1943	380,999	4,514,878	11.85	412,868	5,121,414	12.40
1944	352,271	4,279,062	12.15	398,863	5,017,462	12.58
1945	359,191	4,486,736	12.49	401,080	4,956,901	12.36

[1] In 1944: Crude, 5,683 tons, $52,343; ground, 60,560 tons, $504,739; total, 66,243 tons, $557,082 (exclusive of pinite). In 1945: Crude, 5,949 tons, $33,910; ground and other manufactures, 71,645 tons, $617,290; total, 77,594 tons, $651,200 (exclusive of pinite).
[2] Includes pinite from Nevada.

Sales by States.—In 1945 New York remained the leading producer by a considerable margin, although sales were again less than in the preceding year. In California, Georgia, North Carolina, and Vermont sales increased in 1945 over 1944. The quantities reported as sold in California and North Carolina in 1945 were the highest ever recorded. The greater part of the pyrophyllite marketed comes from North Carolina.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1944–45, by States

State	1944: Short tons	1944: Value	1945: Short tons	1945: Value
California	65,191	$1,054,312	75,564	$1,098,936
Georgia	30,425	363,342	32,433	296,163
Maryland	17,130	161,222	14,707	149,170
Nevada	[1] 9,590	[1] 150,325	7,166	129,952
North Carolina	69,892	645,156	77,529	675,789
Vermont	60,692	724,556	64,046	737,181
Washington	3,288	34,103	2,249	27,591
Other States [2]	142,655	1,884,446	127,386	1,842,119
	398,863	5,017,462	401,080	4,956,901

[1] Includes pinite.
[2] Montana, New Mexico, New York, Pennsylvania, Texas and Virginia.

MARKETS

Seven industries—paint, ceramics, rubber, roofing, paper, toilet preparations, and insecticides—consumed 79 percent of the domestic sales of talc, pyrophyllite, and ground soapstone in 1945, according to reports from the producers. Increases were reported in sales to the ceramic, rubber, roofing, toilet preparations, and insecticide industries. Those in the rubber and insecticide industries were especially noticeable. Use in insecticides now ranks fourth in quantity consumed and takes 9 percent of total sales. There was a marked decline in the quantity used for paints.

Talc, pyrophyllite, and ground soapstone sold by producers in the United States, 1944–45, by uses

Use	1944		1945	
	Short tons	Percent of total	Short tons	Percent of total
Paint	110,767	28	96,485	24
Ceramics	31,932	8	34,258	8
Rubber	51,833	13	62,049	15
Roofing	45,535	11	46,238	11
Paper	27,161	7	27,088	7
Toilet preparations	15,965	4	19,034	5
Insecticides	21,454	5	35,723	9
Foundry facings	6,703	2	6,193	2
Crayons	1,358	(1)	758	(1)
Other uses reported [2]	40,046	10	30,352	8
Use not reported	46,109	12	42,902	11
	[3] 398,863	100	401,080	100

[1] Less than 0.50 percent.
[2] 1944: Chemical war service, refractory, plaster, plastics, bleaching, textile, and other minor uses. 1945: Refractory, plaster, plastics, textile, agriculture, and other minor uses.
[3] Includes pinite.

PRICES

Quoted prices on ground domestic talc per ton, carlots, bags, f. o. b. works, have remained constant for several years. According to the Oil, Paint & Drug Reporter of June 10, 1946, these prices are per ton:

Talc, domestic, ordinary, ground	$14.50–$24.50
California	17.50– 43.00
New York, fibrous, ground, off color, coarse	13.00
New York, fine, 325 mesh—93–94 percent	13.00– 18.00
New York, fine, 325 mesh—98–99.5 percent	15.25– 19.25
New York, fine, 325 mesh—99.85–99.95 percent	17.00– 21.00
Pennsylvania	11.00– 13.50
Vermont	14.00
Talc, imported, Canadian	24.00– 30.00

The prices on pyrophyllite were the same in 1945 and the first half of 1946 as in 1944. According to the same journal these were, in June 1946: Standard, 200-mesh, carlots, bulk, mines, per ton, $10 to $11.50; 325-mesh, same basis, $13.00 to $13.90; No. 3, 200-mesh, carlots, mines, $9.50; 325-mesh, same basis, $11.50. Pyrophyllite in paper bags was $1.50 per ton extra.

The average values of all grades of talc, pyrophyllite, and ground soapstone in the past 5 years, as reported to the Bureau of Mines by producers, are given in the table under "Sales."

On July 23, 1945, the Office of Price Administration issued MPR 592, Specified Construction Materials and Refractories, which superseded the General Maximum Price Regulation and Maximum Price Regulation 188 with respect to transactions covered by this regulation. It became effective July 30, 1945. Prices of talc (including steatite), pyrophyllite, and ground soapstone and of talc crayons, natural sawed and pressed or extruded, formerly covered by MPR 188 and amendments were accordingly placed under MPR 592.

MPR 592, Order 1, Modification of Maximum Prices, of the same effective date, which brings together, restates, and reclassifies the modifications of maximum prices previously contained in Order A–1 under MPR 188 insofar as they applied to commodities now covered by this regulation, restates (sec. 7.2) the maximum prices for specified grades of crude talc produced in Esmeralda County, Nev., and in section 7.3 states that

> The manufacturers' maximum prices for pyrophyllite established pursuant to Maximum Price Regulation No. 592 may be increased by adding an amount not in excess of $0.40 per net ton to the f. o. b. factory prices.

In October 1945 the OPA suspended the above price control on industrial talc, pyrophyllite, and ground soapstone. Agricultural grades, which form only a very small percentage of the total consumption of these materials, were not included in this suspension but were later (May 1946) removed from control.

DEVELOPMENTS IN THE INDUSTRY

The results of the Bureau of Mines investigation of domestic talcs was published early in 1945.[5] This investigation, begun in December 1941 and recessed in 1943, was a general survey of domestic talcs to determine those suitable for the production of radio ceramic or "steatite" insulators. About 200 samples from 46 mines, 26 prospects, and 24 uncertain sources were examined. Samples of a grade satisfactory without beneficiation were obtained from 17 mines and 5 prospects in Inyo County, Calif., and Esmeralda County, Nev. The talcs obtained from the Smith-Dillon and Clark-Teutsch mines in Montana were likewise of satisfactory grade. Reserves of satisfactory-grade material have been tentatively estimated at about 115,000 tons, or a 4 to 5 years' supply at the present rate of consumption. The deposits in the Western States have been supplying the required grade of material. Originally the material came almost exclusively from the Talc City mine of the Sierra Talc Co., Inyo County, Calif. Other mines in that county and in Esmeralda County, Nev., now supply part of the market. Some also comes from Montana and New Mexico.

Most talcs produced in the eastern region—New York and the Appalachians from Vermont to Alabama—are stated to be unsuitable for use in high-frequency insulators, as they are either too refractory, or contain too much iron oxide, or have high linear shrinkage. Talcs

[5] Klinefelter, T. A., Speil, Sidney, and Gottlieb, Sidney, Survey of the Suitability of Domestic Talcs for High-Frequency Insulators: Bureau of Mines Rept. of Investigations 3804, 1945, 58 pp.

from some of these desposits show a possibility of furnishing by beneficiation products that would meet the requirements for high frequency ceramics. The largest reserves of this type are in New York and Alabama. At present, the eastern deposits are not considered usable reserves, however.

Trauffer [6] has described the operations of the International Talc Co. in the Gouverneur district, northern New York.

Steatite ceramic blocks with radio circuits printed on them have been used in radio and electronic apparatus.[7]

Several papers on steatite ceramics have been published recently.[8]

FOREIGN TRADE [9]

Imports.—The reversal in 1944 of the declining trends in the quantity and value of total imports of talc, steatite or soapstone, and French chalk, was only temporary, and in 1945 a decline occurred nearly to the 1943 level in total quantity imported and almost to the 1942 level in total value. Declines occurred in quantities and values of all classes. As usual, the imports were largely of materials "ground, washed, powdered or pulverized, except toilet preparations." Canada was the only source of the ground material and India the chief source of the other classes. (See fig. 2.)

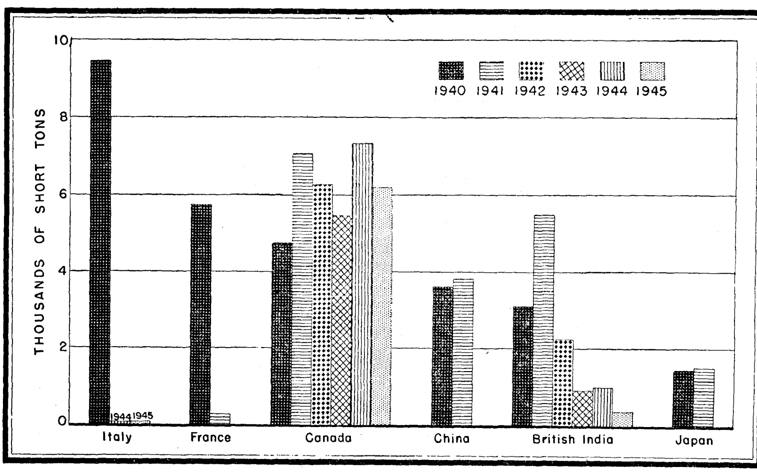

FIGURE 2.—Talc, steatite or soapstone, and French chalk imported for consumption in the United States 1940–45, by leading countries.

[6] Trauffer, W. E., Pioneer Talc Producer Shifting from Direct Water Power to Electricity: Pit and Quarry, vol. 38, No. 7, January 1945, pp. 114–116.

[7] Science News-Letter, Revolution in Radio: Vol. 49, No. 9, Mar. 2, 1946, p. 133.

[8] Hausner, H. H., and Naporan, A. F., Shrinkage of Extruded Steatite Tubes: Ceram. Abs. and Bull., Am. Ceram. Soc., vol. 24, No. 7, July 15, 1945, pp. 246–250.

Thiess, L. E., Steatite Glazes: Jour. and Ceram. Abs., Am. Ceram. Soc. vol. 29, No. 3, Mar. 1, 1946, pp. 84–86.

Gingold, J. J., and Hirsh, E. J., Influence of Glaze on Strength of Steatite Tubes and New Method of Determining Glaze Stresses: Jour. Am. Ceram. Soc., vol. 28, No. 6, June 1, 1945, pp. 168–170.

Ceramic Abstracts and Bulletin, American Ceramic Society, History of the Stupakoff Enterprises: Vol. 24, No. 11, Nov. 15, 1945, pp. 410–414.

Howatt, G. N., Dielectric Properties of Steatite Porcelain: Jour. and Ceram. Abs., Am. Ceram. Soc., vol. 29, No. 5, May 1, 1946, pp. 117–123.

Hausner, H. H., Hermetically Sealed Steatite: Jour. and Ceram. Abs., Am. Ceram. Soc., vol. 29, No. 5, May 1, 1946, pp. 123–128.

Treischel, C. C., and Emrich, E. W., Study of Several Groups of Organic Binders Under Low-Pressure Extrusion: Jour. and Ceram. Abs., Am. Ceram. Soc., vol. 29, No. 5, May 1, 1946, pp. 129–132.

[9] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1941–45, by classes

Year	Crude and unground		Ground, washed, powdered, or pulverized, except toilet preparations		Cut and sawed		Total		Manufactures, n. s. p. f., except toilet preparations (value)
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1941	341	$5,780	18,225	$225,857	71	$10,611	18,637	$242,248	$11,701
1942	286	5,753	8,492	94,687	(1)	36	8,778	100,476	2,704
1943	408	12,195	6,201	64,815	1	40	6,610	77,050	20
1944	696	60,137	7,650	88,207	132	20,639	8,478	168,983	25
1945	385	20,980	6,192	63,260	122	17,618	6,699	101,858	63

[1] Less than 1 ton.

Talc, steatite or soapstone, and French chalk imported for consumption in the United States, 1944–45, by classes and by countries

Country	Crude and unground		Ground, washed powdered, or pulverized, except toilet preparations		Cut and sawed		Total		Manufactures, n. s. p. f., except toilet preparations (value)
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	
1944									
Brazil	10	$159					10	$159	
Canada	8	800	7,333	$75,279	19	$5,900	7,360	81,979	
China									$25
India and Dependencies	641	54,972	293	10,496	113	14,739	1,047	80,207	
Italy	37	4,206	24	2,432			61	6,638	
	696	60,137	7,650	88,207	132	20,639	8,478	168,983	25
1945									
Canada			6,192	63,260	25	7,112	6,217	70,372	
China									63
India and Dependencies	353	16,728			56	5,000	409	21,728	
Italy	32	4,252			41	5,506	73	9,758	
	385	20,980	6,192	63,260	122	17,618	6,699	101,858	63

Exports.—The quantity of "talc, steatite, soapstone, and pyrophyllite, crude and ground" exported from the United States in 1945 was a new record, surpassing the previous all-time record of 1941 by 252 short tons. The total value of these exports in 1945 was likewise a record—$279,178. A large increase, nearly a million dollars, occurred in 1945 in the value of "powders—talcum (in packages), face, and compact" over that of 1944, the value exceeding 2¼ million dollars.

Talcum and other powders exported from the United States, 1941–45

Year	Talc, steatite, soapstone, and pyrophyllite, crude and ground		Powders—talcum (in packages), face, and compact (value)
	Short tons	Value	
1941	10,889	$216,440	$1,229,280
1942	9,246	191,900	678,313
1943	10,693	236,268	756,024
1944	10,709	229,293	1,328,890
1945	11,141	279,178	2,276,758

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WORLD PRODUCTION

The few figures available on the production of talc, pyrophyllite, and ground soapstone in various countries during recent years are shown in the following table.

World production of talc, pyrophyllite, and soapstone, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	80	303	1,168	1,975	4,770	(2)	(2)	(2)
Australia:								
New South Wales	597	612	754	1,153	1,454	1,814	1,874	(2)
South Australia	973	1,115	1,349	2,972	2,577	3,336	3,930	(2)
Tasmania	--------	--------	--------	--------	--------	--------	4	955
Western Australia	--------	--------	--------	--------	308	74	266	(2)
Canada	[3] 9,846	[3] 11,924	21,583	31,417	27,096	23,735	29,579	24,393
China (Manchuria) (exports)	81,215	93,772	[4] 72,495	(2)	(2)	(2)	(2)	(2)
Egypt	1,251	833	2,212	5,229	1,875	2,054	4,265	3,868
Germany:								
Austria (exports)	5,625	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Bavaria	6,805	7,747	9,449	12,970	13,526	(2)	(2)	(2)
Greece	1,293	1,003	(2)	(2)	(2)	(2)	(2)	(2)
India, British	18,888	22,616	30,786	26,571	32,262	16,724	(2)	(2)
Indochina	--------	400	305	(2)	(2)	(2)	(2)	(2)
Italy	53,511	71,363	71,443	73,475	80,462	(2)	(2)	46,287
Madagascar	(2)	(2)	(2)	(5)	(5)	39	(5)	(2)
Morocco, French (exports)	1,702	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Newfoundland	1,605	(2)	284	508	1,580	2,439	224	711
New Zealand	(2)	(2)	(2)	(2)	95	63	25	(2)
Norway	23,703	31,473	17,028	29,059	30,174	(2)	(2)	(2)
Rumania	2,256	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain [6]	8,438	5,545	28,643	29,148	36,497	14,238	10,470	(2)
Sweden	6,797	7,195	7,569	(2)	(2)	(2)	(2)	(2)
Tanganyika Territory	38	5	6	(2)	(2)	(2)	(2)	(2)
Union of South Africa: Transvaal	1,554	449	1,757	1,830	1,985	5,344	2,875	[4] 7,855
United Kingdom	--------	46	1,074	4,532	2,231	2,815	2,829	(2)
United States [7]	193,025	230,402	255,258	377,722	351,952	374,546	361,841	363,852
Uruguay (exports)	952	1,111	1,699	1,867	3,618	1,637	[8] 2,260	(2)

[1] In addition to countries listed, talc or pyrophyllite is reported produced in Brazil, Bulgaria, Chile, Finland, France, Kenya, and U. S. S. R., but data on production are not available.
[2] Data not available.
[3] Excludes soapstone, which is reported only by value and was as follows: 1938, $35,038; 1939, $41,471. Soapstone is sold in the form of both blocks and powder.
[4] January to September, inclusive.
[5] Less than 1 ton.
[6] Includes steatite, as follows—1938: 3,480 tons; 1939: 5,545; 1940: 17,191; 1941: 18,948; 1942: 24,859; 1943: 9,741; 1944: 7,369.
[7] Talc, pyrophyllite, and ground soapstone sold by producers; includes also pinite in 1940, 1941, 1942, and 1944.
[8] Estimate.

Canada.—The Canadian talc and soapstone industry in 1944 was described in official reports as follows:[10]

The value of crude and refined talc and soapstone sold by Canadian producers of these minerals totalled $357,249 in 1944 compared with $266,685 in 1943. Mine shipments of soapstone and talc reported in 1944 by operators in the Province of Quebec amounted to 19,013 short tons valued at $205,127. Production of the higher grades of talc in Canada is confined chiefly to the Province of Ontario, and in 1944 shipments totalling 13,584 tons worth $153,122 were made entirely from a deposit located near Madoc, Hastings County. In British Columbia, crude talc imported from the United States is treated in a mill at Vancouver. Canadian Wartime Metals Corporation discontinued operations on February 29, 1944, at its Lava Talc project located at the Red Mountain and Gold Dollar claims in the Golden mining division of British Columbia; approximately

[10] Canada Department of Trade and Commerce, Dominion Bureau of Statistics, Mining, Metallurgical, and Chemical Branch, The Talc and Soapstone Industry, 1944: Ottawa, Canada, 1945, 7 pp.

seven tons of sawn talc blocks were shipped to the United States for experimental purposes.

Imports of talc and soapstone into Canada during 1944 totalled 6,094 short tons valued at $130,603; they came entirely from the United States. Exports of talc from Canada in 1944 amounted to 11,920 short tons worth $157,178.

During 1944 there were 6 firms reported as active in the industry, 4 in the Province of Quebec, 1 in Ontario, and 1 in British Columbia. * * *

The following information is from a report prepared by the Bureau of Mines, Ottawa:

Ontario supplies all of the prime white powdered talc produced, Quebec furnishing off-color ground talc (in part made from soapstone waste), sawn dimension soapstone, and talc crayons. In recent years, the total output of ground talc of all grades has been about equally divided between these two provinces, with annual shipments averaging between 12,000 and 15,000 tons each.

Canada is self-sufficient in respect to most of the grades of ground talc needed for its industrial requirements, and there is a considerable surplus for export. It also produces most of the sawn dimension soapstone and talc crayons used, but is dependent on imports, obtained mainly from the United States, for certain special qualities of ground talc demanded by the ceramic, paint, and cosmetic trades. Imports of such talc in 1942 and 1943 amounted to approximately one-third of the total domestic consumption of about 15,000 tons.

Following the outbreak of war, a substantial demand for Canadian talc developed in the British market, to supply deficiencies caused by cutting off imports from France, Italy, and Norway. In 1943, all forms of talc, soapstone, and pyrophyllite were placed under strict control and allocation by the British Government, with all purchases and imports to be made for Ministry of Supply account.

In Ontario, all the output comes from the Madoc area, in Hastings County, where production commenced some 40 years ago.

In Quebec, the entire production is obtained from the Eastern Townships, mainly from the Thetford Mines area, and there are also a mine and mill at Highwater, close to the Vermont boundary. All of Canada's output of sawn soapstone blocks comes from the Thetford Mines area.

Owing to the critical need for additional sources of massive, steatitic talc, investigations were made during 1943 and 1944 by Wartime Metals Corporation, a Crown company, of an occurrence of such material near Red Earth Creek in Kootenay Park, British Columbia, but it was decided that the recovery of usable material was too low to justify further work. Samples of yellow steatite from a deposit at the base of Mt. Whymper, several miles south of the above occurrence, were forwarded to the United States for test, but the material proved to be too badly flawed to be usable.

* * * * * * *

The Canadian consumption of ground talc in 1943, as reported by users, totalled 17,201 tons, distribution, by industries, being as follows: paints, 34 percent; roofing products, 23 percent; rubber, 11 percent; pulp and paper, 9 percent; cosmetic and pharmaceutical preparations, 7 percent; insecticides, 5 percent; soaps and cleaners, 3 percent; miscellaneous, 8 percent. Consumption of soapstone furnace blocks by Canadian pulp and paper mills in the same year was 1,076 tons, equivalent to 11,956 cubic feet.

* * * * * * *

Ground talc has a wide price range. * * * Roofing and foundry talcs are the cheapest grades, the users being satisfied with coarser, grey or off-colour material, often soapstone powder or sawing dust, which sells for about $5 to $7 a ton f. o. b. rail. Domestic grey talc, suitable for roofing, rubber, and paper use, sold in 1944 for $8 to $11.75 a ton according to fineness. White talc from Madoc, Ontario, was quoted at $8 to $10 for the coarser grades, $12 to $18 for finer mesh sizes, and $44 for minus 400-mesh material.

FLUORSPAR AND CRYOLITE

By Hubert W. Davis and Gertrude N. Greenspoon [1]

SUMMARY OUTLINE

FLUORSPAR

SUMMARY

Fluorspar production in the United States, which reached an all-time high of 413,700 short tons in 1944 after an unbroken 6-year upward trend, declined to 325,200 tons in 1945. The smaller output was caused largely by suspension of operations at some mines and downward adjustment in operating schedules at many others to conform to the lessened demand for fluorspar that followed the ending of hostilities with Japan on August 14. Also contributing to the drop in output was the Ohio River flood in March, which forced all mines and mills in the Rosiclare district of Illinois to stop operating for about 2 weeks, and heavy rains, which necessitated extra pumping at mines in the Cave in Rock district of Illinois and at some mines in western Kentucky. A number of mines, including the Rosiclare in Illinois and the Keystone, Old Silver, and Ellis in Kentucky, were flooded and put out of production for some time.

Shipments of fluorspar likewise declined to 323,961 tons (413,781 tons in 1944). Despite the loss of output because of the flood and extra pumping, Illinois maintained its rank as the chief producer in 1945 by supplying 45 percent of the domestic shipments.

Consumption of fluorspar, which in 1944 for the first time exceeded 400,000 tons, declined to 356,090 tons in 1945. The drop was due chiefly to severe curtailments at steel and hydrofluoric acid plants after VJ-day owing to war-contract terminations and to production stoppages at steel mills during the mid-August victory celebrations.

Receipts of foreign fluorspar (100,725 tons) in 1945 established a new record, exceeding by 9 percent the previous peak of 1944. As in 1944, the bulk of the fluorspar imported was delivered to the Govern-

[1] Figures on imports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce; those on exports of fluorspar supplied by the producers.

ment stock pile. Exports—usually small—were again insignificant and totaled only 1,420 tons in 1945.

The Government stock-pile objective of 260,000 tons of fluorspar was nearly attained, as 245,728 tons of finished fluorspar had been delivered toward it at the close of 1945; however, of this amount, 46,872 tons have been disposed of, leaving a balance of 198,856 tons of finished fluorspar stocked in the United States on December 31. In addition, 12,600 tons belonging to the United States Government were stored in Spain. All contracts for the purchase of fluorspar for the Government stock pile were terminated during 1945. The finished fluorspar remaining in the Government stock pile when declared surplus will be transferred to the Treasury Procurement Division in accordance with the Surplus Property Act of 1944, Public No. 457, 78th Congress, sec. 22 (a), approved October 3, 1944.

Production of metallurgical-grade and ceramic-grade fluorspar was ample for requirements throughout 1945; because of the satisfactory supply-and-demand relationship in these grades, there were no restrictions on their delivery or use. On the other hand, acid-grade fluorspar was in short supply until VJ-day, and the restriction on its use for nonessential purposes continued in effect until that time. During the first 7 months of 1945, consumption of acid-grade fluorspar averaged about 11,600 tons monthly, whereas domestic production averaged only 8,700 tons.

Salient statistics of fluorspar in the United States, 1936–45, in short tons

Year	Shipments from domestic mines	Foreign trade		Consumption	Stocks at end of year			
		Imports for consumption	Exports		Consumers' plants	Domestic mines [1]	Government stock pile [1]	Total
1936	176,877	25,504	240	182,400	72,600	29,958		102,558
1937	181,230	37,063	456	194,300	90,100	30,539		120,639
1938	80,403	19,622	788	115,100	71,800	34,996		106,796
1939	182,771	16,302	2,976	176,800	90,400	38,619		129,019
1940	233,600	11,873	8,482	218,500	102,100	43,866		145,966
1941	320,669	7,524	12,184	303,600	108,900	31,997		140,897
1942	360,316	2,151	9,020	360,800	96,000	19,429		115,429
1943	406,016	43,769	9,068	388,885	105,933	19,026	36,223	161,182
1944	413,781	87,200	1,980	410,170	98,446	[2] 19,021	129,885	[2] 247,352
1945	323,961	103,133	1,420	356,090	103,148	20,249	198,856	322,253

[1] Finished fluorspar only.
[2] Revised figure.

The shortage in domestic production was met by milling to acid grade a substantial tonnage of Mexican fluorspar and by the use (after drying) of an appreciable quantity of flotation concentrates from Newfoundland; these tonnages were from the Government stock pile. The Mexican fluorspar, being of much higher grade than domestic milling ore, lends itself to higher recovery.

The greatly increased demand for acid-grade fluorspar during the war resulted from its expanded use in both anhydrous and aqueous hydrofluoric acid. Anhydrous hydrofluoric acid has three major uses—as a catalyst for producing aviation alkylate (widely used in high-octane aviation blends), as a raw material in the production of Freon (which gained new prominence when it began to be used as the propellant in the aerosol insecticide bomb), and for certain secret military uses, including the atom bomb. The bulk of the aqueous hydrofluoric acid is employed in producing fluorine chemicals—aluminum fluoride, sodium aluminum fluoride, sodium fluoride, and others. The little-publicized fluorine chemicals and their contribution to the war program are discussed in an article by Callaham.[2] The aerosol insecticide bomb is described in much detail in Steel.[3]

With the end of the war with Japan, consumption of acid-grade fluorspar declined phenomenally to an average of about 4,800 tons monthly during the last 4 months of 1945. The postwar outlook for acid-grade fluorspar, as well as other grades, has been discussed by Waggaman and Ralston.[4]

Deliveries of fluorspar to consumers in the United States totaled 357,624 short tons in 1945 (313,092 tons from domestic mines and 44,532 tons from foreign sources); in addition, 9,449 tons of finished fluorspar from domestic mines were delivered to Government stock piles. In 1944 deliveries to consumers totaled 398,916 tons (387,405 tons from domestic mines, 3,696 tons from Government stock piles, and 7,815 tons from foreign sources); in addition, 24,396 tons of finished fluorspar from domestic mines were delivered to Government stock piles. Total deliveries to steel plants in the United States decreased to 207,100 tons from 221,000 tons in 1944 and those to hydrofluoric acid plants dropped to 102,734 tons from 126,991 tons in 1944; sales to glass and enamel plants advanced to 36,508 tons from 29,859 tons in 1944.

The average composite selling price ($30.72 a short ton) of all grades of fluorspar (both domestic and foreign) delivered to consumers in the United States was $0.12 more than in 1944 ($30.60). The average selling price of all grades of domestic fluorspar shipped in 1945 ($30.55) established a new peak and was $0.33 greater than the previous high of 1944. The average selling price f. o. b. Illinois-Kentucky mines of metallurgical-grade fluorspar shipped to domestic steel plants was $29.94 a ton ($29.73 in 1944) and of that shipped to domestic manufacturers of hydrofluoric acid $37.72 ($36.51 in 1944).

The total quantity of fluorspar shipped in and imported into the United States from about 1870 through 1945 was approximately 7,648,000 short tons, comprising about 83 percent from domestic mines and 17 percent from foreign sources.

The total shipments since commercial production was begun (around 1870) in the United States through 1945 were approximately 6,353,000 tons, of which Illinois and Kentucky contributed 53 and 35 percent, respectively. Imports of fluorspar into the United States from 1910 through 1945 were about 1,138,000 short tons, and imports before 1910 are estimated at 157,000 tons—a total of about 1,295,000 tons, of which the United Kingdom and Germany contributed 41 and 16 percent, respectively.

It is noteworthy that, of the total domestic shipments, 2,241,114 tons (35 percent) were shipped during the past 7 years (1939–45). Despite the drain on resources of fluorspar during these years,

[2] Callaham, J. R., Fluorine Industry Molds a Postwar Career from Wartime Service: Chem. and Met. Eng., vol. 52, No. 3, March 1945, pp. 94–99.
[3] Steel, Bug Bombs: Vol. 116, No. 26, June 25, 1945, pp. 118–119, 156, 160.
[4] Waggaman, W. H., and Ralston, O. C., Postwar Prospects for Fluorspar are Bright: Min. and Met., vol. 26, No. 462, June 1945, pp. 295–299.

Pehrson[5] states that, as of December 31, 1944, about 60 percent of the total known domestic reserves, as estimated by the Federal Geological Survey and the Bureau of Mines, remained, and that commercial reserves as of that date would be sufficient for 40 years at the 1935–39 annual rate of use of domestic fluorspar.

Fluorspar shipped[1] from mines in the United States, 1880–1945, by States, in short tons[2]

Year	Arizona	Colorado	Illinois	Kentucky	Nevada	New Mexico	Other States[3]	Total
1880–1909[4]	718	5,807	330,120	203,929		710	1,020	542,304
1910–19[4]	843	83,220	1,004,633	281,124	400	20,997	6,110	1,397,327
1920–29[4]	181	71,920	630,804	512,518	2,344	31,216	2,319	1,251,302
1930–39[4]	3,351	50,935	466,595	515,727	14,693	23,931	3,090	1,078,322
1940	1,370	11,032	104,698	103,939	5,803	6,616	142	233,600
1941	1,428	15,566	133,333	142,862	8,967	17,591	922	320,669
1942	714	31,743	161,949	134,133	8,020	22,542	1,215	360,316
1943	1,328	49,145	198,789	109,849	8,653	37,050	1,202	406,016
1944	976	65,209	176,259	112,791	7,293	42,973	8,280	413,781
1945	1,126	52,437	147,251	95,142	7,038	14,449	6,518	323,961
	12,035	437,014	3,354,431	2,212,014	63,211	218,075	30,818	6,327,598

[1] Figures for 1880–1905 represent production.
[2] Figures on production not recorded for Colorado before 1905, for Illinois before 1880, and for Kentucky before 1886 and for 1888–95; total unrecorded production, chiefly from Illinois, estimated at 25,000 tons.
[3] California, New Hampshire, Tennessee, Texas, Utah, Washington, and Wyoming.
[4] Figures, by years, for 1880–1909 are given in Mineral Resources of the United States, 1925, pt. II, p. 13; for 1910–39 in Minerals Yearbook, Review of 1940, p. 1297.

Fluorspar imported into the United States, 1910–45, by countries, in short tons[1]

Year	Africa	Canada	France	Germany	Mexico	Newfoundland	Spain	United Kingdom	Other countries[2]	Total
1910–19[3]		2,433		1,227				183,265	11	186,936
1920–29[3]	54,550	16,197	57,565	119,903			11,774	178,482	16,161	454,632
1930–39[3]	17,527	468	65,815	89,056	550	17,922	34,525	6,940	7,989	240,792
1940			5,735		1,555	3,640	112		829	11,871
1941					4,452		3,070	2		7,524
1942		(4)			2,151					2,151
1943	570				20,515	7,144	15,540			43,769
1944	3,557	69			58,324	16,072	9,177	1		87,200
1945		[5] 2,361			62,575	[5] 10,875	27,322			103,133
	76,204	[5] 21,528	129,115	210,186	150,122	[5] 55,653	101,520	368,690	24,990	1,138,008

[1] Imports Aug. 1 to Dec. 31, 1909, totaled 6,971 tons. Earlier imports not separately recorded but estimated at 150,000 tons and virtually all from United Kingdom.
[2] Argentina, Australia, Austria-Hungary, Belgium, China, Czechoslovakia, Italy, Netherlands, Norway, Tunisia, and Soviet Russia in Asia.
[3] Figures, by years, for 1910–39 are given in Minerals Yearbook, Review of 1940, p. 1298.
[4] Less than 1 ton.
[5] Bureau of Mines has determined that 1,691 tons credited to Canada by the U. S. Department of Commerce originated in Newfoundland.

PRODUCTION AND SHIPMENTS

Production of finished fluorspar totaled 325,200 short tons in 1945, including 121,670 tons of flotation concentrates. In addition, about 34,000 tons of crude ore, equivalent to 16,300 tons of finished fluorspar, were mined but not milled in 1945. Thus, total mine production (expressed in terms of finished fluorspar) was 341,500 tons in 1945 compared with 396,000 tons in 1944. Of the mine production in 1945,

[5] Pehrson, E. W., The Mineral Position of the United States and the Outlook for the Future: Paper presented before the New York Section, Am. Inst. Min. and Met. Eng., Feb. 19, 1945, 18 pp.

10 mines producing over 10,000 tons each supplied 161,000 tons or 47.2 percent, 10 mines producing 5,000 to 10,000 tons each supplied 76,000 tons or 22.3 percent, 30 mines producing 1,000 to 5,000 tons each supplied 80,000 tons or 23.4 percent, and 13 mines producing 500 to 1,000 tons each supplied 9,000 tons or 2.6 percent; thus, 63 mines produced 326,000 tons or 95.5 percent of the total. The remainder (15,500 tons or 4.5 percent) of the production, in quantities ranging from a few tons to 500 tons, came from an undetermined number of small mines, prospects, waste dumps, and old workings of abandoned mines.

Fluorspar shipments from domestic mines in 1945 aggregated 323,961 short tons valued at $9,896,879, decreases of 22 percent in quantity and 21 percent in total value from the all-time high of 1944. Of the 1945 total, 52,718 tons were shipped by river or river-rail for delivery to consumers as compared with 69,536 tons in 1944.

Illinois (45.4 percent) and Kentucky (29.4 percent) supplied 74.8 percent of the fluorspar shipped in 1945 compared with 69.9 percent in 1944. Shipments from Illinois and Kentucky were 16 percent less than in 1944 compared with a loss of 35 percent from other producing States.

The average value of all grades of finished fluorspar shipped in 1945 was $30.55 a short ton ($0.33 more than the 1944 average).

The following table shows shipments of fluorspar, by States, in 1944 and 1945.

Fluorspar shipped from mines in the United States, 1944–45, by States

State	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average		Total	Average
Illinois	176,259	$5,954,991	$33.79	147,251	$5,014,807	$34.06
Kentucky	112,791	3,363,788	29.82	95,142	2,832,945	29.78
Colorado	65,209	1,604,043	24.60	52,437	1,333,735	25.43
New Mexico	42,973	1,205,830	28.06	14,449	390,331	27.01
Nevada	7,293	251,421	23.37	7,038		
Utah	3,466			2,973	304,045	22.43
Texas	4,769	100,381	21.05	3,413		
Washington				132		
Arizona	976	21,983	22.52	1,126	21,016	18.66
California	26	650	25.00			
Wyoming	19	400	21.05			
	413,781	12,503,487	30.22	323,961	9,896,879	30.55

Shipments of fluorspar in 1945 comprised 193,524 tons of fluxing gravel (including 4,182 tons of flotation concentrates which were blended with fluxing gravel) and foundry lump, 129,806 tons of ground and flotation concentrates, and 631 tons of acid lump. The bulk of the fluxing-gravel and foundry-lump fluorspar was shipped to steel plants and iron foundries; but a comparatively small tonnage moved to plants making cement, ferro-alloys, nickel, basic refractories, and fluxing compounds, to smelters of secondary metals, and to the Government stock pile. Of the ground and flotation concentrates shipped in 1945, hydrofluoric acid plants took 61 percent; the remainder went to aluminum- and magnesium-reduction works, to manufacturers of ferro-alloys, steel, glass, enamel, and welding rod, to smelters of secondary metals, and to the Government stock pile. Except for 36 tons to steel plants and 2 tons to nonferrous smelters, all the acid-lump fluorspar was shipped to hydrofluoric acid plants.

The next table shows shipments of fluorspar, by grades and industries, in 1944 and 1945.

Fluorspar shipped from mines in the United States, 1944–45, by grades and industries, in short tons

Grade and industry	1944	1945
Fluxing gravel and foundry lump:		
Ferrous	210,930	[1] 184,645
Nonferrous	1,264	1,170
Cement	646	326
Miscellaneous	389	158
Government stock pile	23,824	7,225
Exported	55	
	237,108	[1] 193,524
Acid lump:		
Ferrous	20	36
Nonferrous		2
Hydrofluoric acid	1,572	593
	1,592	631

Grade and industry	1944	1945
Ground and flotation concentrates:		
Ferrous	[2] 14,715	[2,3] 6,791
Nonferrous	6,157	2,211
Glass and enamel	29,859	35,960
Hydrofluoric acid	119,512	79,562
Miscellaneous	2,341	1,638
Government stock pile	572	2,224
Exported	1,925	1,420
	175,081	[3] 129,806
Total:		
Ferrous	225,665	191,472
Nonferrous	7,421	3,383
Cement	646	326
Glass and enamel	29,859	35,960
Hydrofluoric acid	121,084	80,155
Miscellaneous	2,730	1,796
Government stock pile	24,396	9,449
Exported	1,980	1,420
	413,781	323,961

[1] Includes 4,182 tons of flotation concentrates, which were blended with fluxing gravel.
[2] Includes pelletized gravel.
[3] Excludes 4,182 tons of flotation concentrates, which were blended with fluxing gravel.

SHIPMENTS, BY USES

As is evident from the following table and figure 1, the predominant purchaser of fluorspar is the steel industry, which also consumes substantial quantities of hydrofluoric acid and sodium fluoride, in which fluorspar is the basic material.

Fluorspar shipped from mines in the United States, 1944–45, by uses

Use	1944				1945			
	Quantity		Value		Quantity		Value	
	Percent of total	Short tons	Total	Average	Percent of total	Short tons	Total	Average
Steel	53.01	219,361	$6,087,077	$27.75	57.44	186,073	$5,182,059	$27.85
Iron foundry	.98	4,044	109,869	27.17	1.05	3,422	94,852	27.72
Glass	6.57	27,174	892,761	32.85	9.97	32,300	1,033,737	32.00
Enamel	.65	2,685	90,444	33.68	1.13	3,660	128,612	35.14
Hydrofluoric acid	29.26	121,084	4,251,686	35.11	24.74	80,155	2,896,267	36.13
Miscellaneous	3.15	13,057	416,672	31.91	2.31	7,482	254,560	34.02
Government stock pile	5.90	24,396	589,069	24.15	2.92	9,449	260,853	27.61
	99.52	411,801	12,437,578	30.20	99.56	322,541	9,850,940	30.54
Exported	.48	1,980	65,909	33.29	.44	1,420	45,939	32.35
	100.00	413,781	12,503,487	30.22	100.00	323,961	9,896,879	30.55

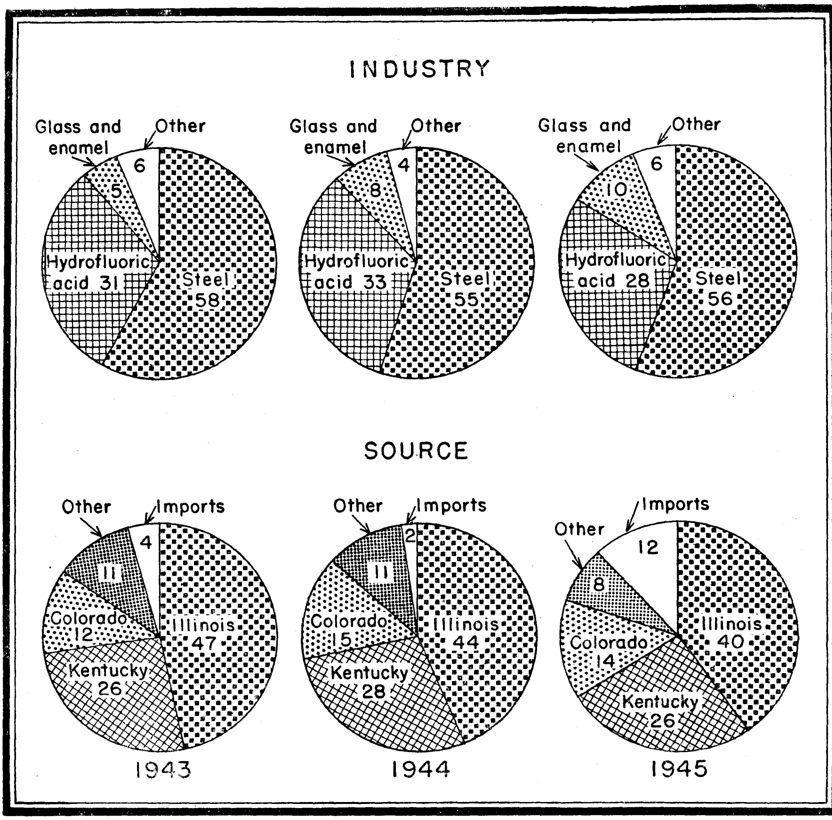

FIGURE 1.—Fluorspar sales (domestic and foreign) to consumers in the United States, 1943–45, by consuming industries and by sources, in percent.

CONSUMPTION AND CONSUMERS' STOCKS

The following tables give data on consumption and consumers' stocks of fluorspar.

Fluorspar (domestic and foreign) consumed and in stock in the United States, 1944–45, by industries, in short tons

Industry	1944			1945		
	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31	Consumption	Stocks at consumers' plants Dec. 31	In transit to consumers' plants Dec. 31
Basic open-hearth steel	201,788			176,488		
Electric-furnace steel	27,307	56,956	6,566	20,873	67,800	5,871
Bessemer steel	1,106			555		
Iron foundry	4,101	1,345		3,877	1,082	51
Ferro-alloys	3,714	876		2,909	1,013	
Hydrofluoric acid	129,553	27,249	1,325	109,315	20,757	506
Primary aluminum	1,487	696		1,190	665	
Primary magnesium	5,594	943		811	757	
Glass	27,315	5,621	950	31,874	5,962	681
Enamel	2,547	1,202	98	3,695	1,433	101
Welding rod	1,928	175	1	1,457	257	
Cement	421	1,278		365	1,214	
Miscellaneous	3,309	2,105	101	2,681	2,208	12
	410,170	98,446	9,041	356,090	103,148	7,222

Production of basic open-hearth steel and consumption and stocks of fluorspar (domestic and foreign) at basic open-hearth steel plants, 1941–45

	1941	1942	1943	1944	1945
Production of basic open-hearth steel ingots and castings……long tons	66,056,000	67,821,000	69,695,000	71,387,000	64,510,000
Consumption of fluorspar in basic open-hearth steel production……short tons	191,300	217,100	205,676	201,788	176,488
Consumption of fluorspar per ton of steel made……pounds	5.8	6.4	5.9	5.7	5.5
Stocks of fluorspar at basic open-hearth steel plants at end of year……short tons	84,200	60,400	57,200	53,100	63,900

Fluorspar was reported consumed in 38 States and the District of Columbia in 1945, but 3 States—Illinois, Ohio, and Pennsylvania—used 199,625 tons or 56 percent of the total consumption. Pennsylvania was again the chief consuming State; it ranked first in consumption of fluorspar in both steel and glass and second in hydrofluoric acid. Illinois maintained its rank as the largest consumer of fluorspar in hydrofluoric acid in 1945.

The next table shows, so far as possible without revealing the figures of individual companies, the consumption of fluorspar, by States, in 1944 and 1945.

Fluorspar (domestic and foreign) consumed in the United States, 1944–45, by States, in short tons

State	1944	1945
Alabama, Georgia	11,120	9,177
Arkansas, Florida, Louisiana, Mississippi, North Carolina	322	3,894
California	10,160	10,416
Colorado, Iowa, Utah	11,844	11,460
Connecticut	1,317	497
Delaware, District of Columbia, New Jersey	34,924	31,314
Illinois	65,839	54,397
Indiana	26,414	27,355
Kansas, Nebraska, Wyoming, Arizona, Nevada, South Dakota (1944)	609	
Kansas, Nebraska, Wyoming (1945)		141
Arizona (1945)		---------
Nevada (1945)		---------
South Dakota (1945)		---------
Kentucky, Maryland	8,814	7,381
Maine (1944)	---------	
Massachusetts, Rhode Island (1944)	1,488	
Maine, Massachusetts, Rhode Island (1945)		1,294
Michigan	13,705	9,168
Minnesota, Wisconsin	2,082	1,507
Missouri	3,186	2,577
New York	18,774	16,386
Ohio	69,137	59,232
Oklahoma	3,201	3,571
Oregon, Washington	3,162	1,692
Pennsylvania	104,608	85,996
Tennessee	1,726	1,491
Texas	11,334	11,042
Virginia	302	157
West Virginia	6,102	5,945
	410,170	356,090

PRICES

Prices fixed by the Office of Price Administration on July 1, 1943, remained in effect in 1945; they were $30 to $33 a short ton for metallurgical-grade fluorspar and $37 a ton for acid and ceramic grades.

STOCKS AT MINES OR SHIPPING POINTS

According to reports of producers, the quantity of fluorspar in stock at mines or shipping points at the close of 1945 totaled 72,473 tons or 16 percent more than in 1944. These stocks comprised 20,249 tons of finished fluorspar and 52,224 tons of crude fluorspar (calculated to be equivalent to 27,000 tons of finished fluorspar).

Stocks of fluorspar at mines or shipping points in the United States, December 31, 1944 and 1945, by States, in short tons

State	1944			1945		
	Crude [1]	Finished	Total	Crude [1]	Finished	Total
Arizona		68	68		43	43
California	150		150	150		150
Colorado	[2] 3,534	1,033	[2] 4,567	3,674	790	4,464
Idaho	50		50	50		50
Illinois	32,507	8,694	41,201	33,639	10,328	43,967
Kentucky	2,850	[2] 8,021	[2] 10,871	2,382	7,877	10,259
Nevada		101	101		101	101
New Mexico	[2] 4,122	450	[2] 4,572	12,329	369	12,698
Texas		430	430		535	535
Utah		224	224		169	169
Washington					37	37
	[2] 43,213	[2] 19,021	[2] 62,234	52,224	20,249	72,473

[1] This crude (run-of-mine) fluorspar must be beneficiated before it can be marketed.
[2] Revised figure.

TECHNOLOGIC DEVELOPMENTS

Interest in the heavy-media and flotation processes for treating fluorspar ores continued in 1945. With the heavy-media process, lower-grade ore can be mined and beneficiated than is economical with jigs, treatment costs are lowered, a better concentrate with lower tailing losses is obtained, and production is increased. The flotation process is now used successfully at many mines to concentrate the disseminated ores that could not be jigged and also to recover additional fluorspar from the slime overflow at gravity-concentrating plants.

Western Minerals Co. completed a small heavy-media plant to serve the Mitchem mine near Keller, Ferry County, Wash.; it began operating in February 1945.

To cut down the loss of ferrosilicon, the Rosiclare Lead & Fluorspar Mining Co., Rosiclare, Ill., made certain adjustments in its heavy-media plant, which began operating in March 1944.

In 1945 the Aluminum Ore Co., which has a flotation mill at Rosiclare to produce acid-grade fluorspar concentrates, had under construction a heavy-media unit. Concerning the heavy-media unit of the Aluminum Ore Co., the American Cyanamid Co. reports as follows:[6]

> * * * Operating experience has demonstrated that any great lowering of the head feed value makes it difficult to maintain fluorspar recoveries and the grade of concentrate. Consequently, when mining operations dictated the utilization of "low-grade" ore, it became necessary to make a revision in milling methods. The development of some suitable means to treat this "low-grade" ore economi-

[6] American Cyanamid Co., Heavy-Media Separation Processes: Ore Dressing Notes 14, December 1945, pp. 41–42.

cally would make possible the production of many thousands of tons of concentrates from material that is now considered waste.

Various types of concentration tests were made on this low-grade ore and it was found that treatment by a Heavy-Media Separation unit would produce a superior grade of mill feed. Accordingly, it was decided to install such a unit ahead of flotation.

This type of treatment will reject one-third to one-half of the minus 2-inch, plus 10-mesh material in the feed, with a loss of approximately 5 percent of the fluorspar values. This is possible because the ore is naturally "free milling"; liberation of most of the gangue minerals being accomplished by a minus half inch crush. Estimated treatment costs are low and it is felt that a part of these costs will be offset by lowered costs for grinding and flotation. These sections profit by the removal of the gangue in coarse sizes, as such material is the hardest to grind and in grinding forms slimes which are detrimental to flotation. * * *

The unit is designed to treat 25 tons of crude ore per hour and by rejecting one-third to one-half of the coarse material in the feed will supply an enriched product for flotation feed. Resulting advantages will be cleaner mining and increased ore reserves due to the ability to mine ore of lower grade than is now possible, increased flotation recoveries, increased flotation capacity and lowered flotation and grinding costs. These advantages should result in a longer property life and will assist in the conservation of a national resource which seems to be none too plentiful.

Flotation plants were completed in 1945 near Colorado Springs, Colo., by Kramer Mines, Inc., near Salida, Colo., by the Chaffee County Fluorspar Corp. (later acquired by United States Fluorspar, Inc.), and at Marion, Ky., by Minerals Flotation Corp. Davenport Mine, Inc., installed six flotation cells to treat sand spar at the Davenport mine near Salem, Ky. The Western Fluorite Co. added a flotation unit to its milling plant to treat ore from its Eagle Mountains mine near Van Horn, Tex. The Rosiclare Lead & Fluorspar Mining Co. added a battery of cells to its flotation mill at Rosiclare, Ill. Output of flotation concentrates from domestic ore totaled 121,670 short tons in 1945 compared with 156,672 tons in 1944. In addition, flotation mills in the United States recovered 17,374 and 4,855 tons, respectively, from milling Mexican ore in 1945 and 1944.

The Bureau of Mines continued its metallurgical studies on fluorspar. Further progress was made in perfecting the separation of fluorspar and barite, and an investigation of various binders for agglomerating fine fluorspar for metallurgical use was continued at the Rolla Laboratory.

According to Jardine,[7] a metallurgical concern in Salt Lake City is said to have developed an improved method for the treatment of complex fluorite ore to produce acid-grade concentrate. The treatment involves a new flotation technique in which barite and calcite are depressed and fluorite floated.

FLUORSPAR INDUSTRY IN 1945, BY STATES

Arizona.—Production in Arizona in 1945, totaling 1,100 short tons, came from mines and prospects in Greenlee, Maricopa, and Yuma Counties; that from Greenlee County was shipped to a flotation plant at Deming, N. Mex. The concentrates recovered from the fluorspar, rather than the milling ore, have been credited in the statistics to Arizona. The fluorspar from Maricopa County came from the Contact and Mammoth mines operated by the Big Spar Mining & Milling Co., the West End mine operated by Isaac Campbell, the

[7] Jardine, F. M., Ore Concentrating and Milling: Min. and Met., vol. 26, No. 458, February 1945, p. 64.

Union Hill and West End mines operated by Harry Hershkowitz, and the Contreras mine operated by Frank L. Metler and Raymond Contreras. The fluorspar from these mines, which are near Wickenburg, was shipped to steel plants. The Big Spar Mining & Milling Co. was installing a jig plant to treat ore from its mines. The fluorspar from Yuma County was a byproduct from the Sonora lead mine and was shipped to a steel plant and to an iron foundry. The Southwestern Mineral Co., which has a flotation plant near Duncan, produced a small quantity of off-grade concentrates which were sold to a flotation plant at Deming, N. Mex.

California.—No fluorspar was reported produced in California in 1945, nor did the plants of Industrial Minerals & Chemical Co. at West Berkeley and Robinson & Stephens at La Verne grind any fluorspar during the year.

Colorado.—Chiefly because of greatly reduced operations by the Western Fluorspar Corp.—largest producer in 1944—and the Fluorspar Processing Co., production of finished fluorspar declined to 52,200 tons in 1945 from 65,300 tons in 1944. In addition, some crude ore equivalent to 200 tons of finished fluorspar was mined but not milled in 1945. Thus, production (expressed in terms of finished fluorspar) totaled 52,400 tons in 1945 compared with 53,900 tons in 1944. Output came from Boulder, Chaffee, Jackson, Mineral, and Park Counties.

Shipments from Colorado were 52,437 tons in 1945 compared with 65,209 tons in 1944. The 1945 shipments comprised 26,838 tons of metallurgical-grade fluorspar and 25,599 tons of flotation concentrates.

During 1945 Harry M. Williamson & Son improved its flotation unit by adding a classifier, a filter, a conditioner, and a boiling circuit. At the Emmett and Argo mines each shaft was sunk an additional 100 feet. Production of finished fluorspar was 23 percent more than in 1944 and comprised almost equal quantities of fluxing gravel and acid-grade flotation concentrates. The company's entire production was under contract to the Office of Metals Reserve until December 12, and as a consequence the decline in demand after VJ-day had little effect on its 1945 operations. The ore treated in the mill came chiefly from the company-operated Emmett mine, but some was also contributed by its Argo and Blue Jay mines, all in Boulder County.

Production of flotation concentrates at the mill (near Jamestown) of General Chemical Co. was 5 percent less than in 1944. The output of the mill was shipped to the hydrofluoric acid plants of the company. The flotation-mill feed comprised ore from the company-operated Alice, Burlington, Chancellor, Invincible, and Yellow Girl mines in Boulder County and some purchased ore. This company also operates a flotation mill in New Mexico.

The fluorspar properties of the Colorado Fluorspar Corp. near Salida, Chaffee County, were sold on February 5 to Colorado Fluorspar Mines, Inc., which immediately started to increase the productive capacity of both mine and mill. A 5 by 5 ball mill, a duplex classifier, six flotation cells, a 3 by 30 rotary drier, and two banks of jigs were added to the mill. A three-compartment shaft was sunk, and a 75-foot head frame and a double-drum hoist were installed at the mine. Sinking the shaft an additional 100 feet was in progress at the end of the year. A new crushing plant was installed, and a

200-ton steel ore bin was erected. The combined production of both operators in 1945 was 56 percent greater than in 1944. The 1945 output comprised 46 percent fluxing gravel and 54 percent flotation concentrates.

The entire output of the American Fluorspar Corp. was obtained from its Dostal mine near Salida. Production of fluxing-gravel fluorspar was 32 percent greater than in 1944; but its output of milling ore, which was sold to local mills, was 94 percent less. The flotation mill of the Fluorspar Processing Co.—on property of the American Fluorspar Corp.—was only operated in January and 10 days in February 1945 as compared with 12 months in 1944, consequently production of fluorspar concentrates was 97 percent less.

The new flotation mill of the Chaffee County Fluorspar Corp. near Salida was brought into production in February 1945. After making a small output, the mill and mine were sold to United States Fluorspar, Inc., on September 1, since which time that company has been developing the mine and improving the flotation plant by the addition of cells, a classifier, and a ball mill to replace a rod mill. The company also has installed pelletizing equipment. Meanwhile, a small quantity of flotation concentrates was produced.

The heavy-media plant of Western Fluorspar Corp. near Northgate, Jackson County, was closed during the first 4 months of 1945 for equipment repairs, and on August 26 it was again closed because of reduced demand for fluorspar. Consequently, production of fluxing-gravel fluorspar in 1945 was 79 percent less than in 1944.

The Crystal prospect—a new discovery—also near Northgate, was being developed in 1945.

The new flotation mill of Kramer Mines, Inc., near Colorado Springs, El Paso County, began operating in February 1945 but discontinued production in September. The mill feed comprised ore from the company-operated mines, also near Colorado Springs.

The Wagon Wheel Gap mine, in Mineral County, of the Colorado Fuel & Iron Corp. was operated throughout 1945, but output was 10 percent less than in 1944.

A small quantity of fluorspar was produced in 1945 by Luke E. Smith at the Bear Cat mine near Jefferson, Park County.

The fluorspar deposits of Colorado have been described in some detail by Cox.[8]

During 1945 a fluorspar section of the Colorado Mining Association was formed in the interest of the industry in Colorado, New Mexico, and Utah.

Idaho.—A 60-ton flotation mill to serve the Chamac mine near Forney, Lemhi County, was reported completed in 1944 by A. E. Chambers. Except for a short test run in 1944, the mill has not operated.

Illinois.—Partly because of the Ohio River flood in March and partly because of reduced demand following VJ-day, production of fluorspar in Illinois declined in 1945; nevertheless, Illinois maintained its rank as the chief producing State. Production of finished fluorspar was 148,900 short tons in 1945; about 98 percent came

[8] Cox, D. C., General Features of Colorado Fluorspar Deposits: Proc. Colorado Sci. Soc., vol. 14, No. 6, 1945, pp. 263–285.

from Hardin County and 2 percent from Pope County. In addition, some crude ore equivalent to 2,500 tons of finished fluorspar was mined but not milled in 1945. Thus, production (expressed in terms of finished fluorspar) totaled 151,400 tons in 1945 compared with 177,000 tons in 1944. Much Kentucky fluorspar is milled in Illinois, and some Illinois fluorspar is milled in Kentucky; the finished fluorspar so recovered, as well as that shipped, is credited in the statistics to the State of origin. The Argo, Austin, Blue Diggings, Crystal, Deardorff, Douglas, Fairview, West Green, Hawkins, Hillside, Knox, Midway-North Boundary-Air Shaft, Minerva, Rose Creek, Rosiclare, Victory, and Wall properties supplied about 97 percent of the fluorspar produced in Illinois in 1945; the remainder came from many mines and prospects, including the W. L. Davis, Deep Shaft, East Green, Hill, Humm, Iron Hill, Lead Hill, Preen, Recovery Shaft, Red Tipple, Rock Candy Mountain, and Winn.

Shipments of fluorspar from Illinois (147,251 tons) were 16 percent less than in 1944 but constituted 45 percent of the total shipped. The 1945 shipments comprised 65,440 tons to steel plants, 55,688 tons to hydrofluoric acid plants, 19,171 tons to glass and enamel plants, 6,166 tons to iron foundries, nonferrous smelters, aluminum- and magnesium-reduction plants, and ferro-alloy, nickel, and welding-rod manufacturers, and 786 tons to Brazil, Canada, and Peru. Of the 1945 total, 30,327 tons were shipped by river or river-rail to consumers compared with 41,790 tons in 1944.

The Aluminum Ore Co., largest producer of fluorspar in the United States in 1944, dropped to fourth place in 1945, because of a 44-percent decline in output at its flotation mill. The mill feed comprised ore from the company-operated Argo, Blue Diggings, and Fairview mines. Development was carried on at various levels of these mines in 1945. A small tonnage of Mexican ore was also milled by the company; but the flotation concentrates so recovered, as well as shipped, are not included in the statistics for Illinois. The Fairview and Blue Diggings mines and the flotation mill have been described briefly by Avery.[9]

The Crystal Fluorspar Co. produced 29 percent less fluorspar at its Crystal mine in 1945 than in 1944. The company did 14,043 feet of churn and diamond drilling in 1945.

Production of gravel and flotation concentrates by Inland Steel Co. (successor to Hillside Fluor Spar Mines on June 1) was 30 and 20 percent, respectively, less than in 1944. The mill feed comprised ore from the Hillside and Wall mines at Rosiclare, Ill., and the Barnes, Guill, and Keystone mines near Marion, Ky., purchased ore chiefly from the Austin, Douglas, Knox, Lead Hill (Grischy), and Rose Hill mines, and tailings from previous milling operations. Production and shipments of finished fluorspar from the Barnes, Guill, and Keystone mines have been credited in the statistics to Kentucky. The company acquired the Barnes mine in Kentucky and the Rock Candy Mountain mine in Illinois in 1945.

The Victory mine of the Victory Fluorspar Mining Co. produced 17 percent less fluorspar than in 1944. The mine was closed August 9

[9] Avery, W. M., Aluminum Ore Company Answered S. O. S. for Vital Defense Material: Pit and Quarry vol. 38, No. 4, October 1945, pp. 72–75.

because of a strike. On August 13 the interests of the other partners in the Victory Fluorspar Mining Co. were purchased by Martin Schwerin.

The flotation mill of Mahoning Mining Co. produced 13 percent less fluorspar concentrates from domestic ore than in 1944. The mill feed comprised ore from the W. L. Davis, Deardorff, East Green, and West Green mines near Cave in Rock, Ill., the Klondike and Mineral Ridge mines near Smithland, Ky., and some purchased ore. Production of finished fluorspar comprised 80.3 percent acid-grade, 19.4 percent pelletized gravel, and 0.3 percent filter cake; the filter cake was sold to local producers for blending with fluxing gravel. Production and shipments of finished fluorspar from the Klondike and Mineral Ridge mines have been credited in the statistics to Kentucky. A comparatively small tonnage of Mexican fluorspar was also milled by the company in 1945; the flotation concentrates so recovered, as well as shipped, are not included in the statistics for Illinois.

The Rosiclare Lead & Fluorspar Mining Co. operated the Deep Shaft, Hawkins, Midway-North Boundary-Air Shaft, Recovery Shaft, and Rosiclare properties in 1945. The Rosiclare mine was flooded by the high water from the Ohio River in March and was out of production until May 20, when hoisting of ore was resumed; nevertheless, it was the chief producing mine of the company. The ore from the company mines is mill feed for its heavy-media-process plant and flotation mill. A substantial quantity of tailings from previous milling operations was treated in the heavy-media plant in 1945. Production of finished fluorspar of all grades was 9 percent less than in 1944, and shipments were 14 percent smaller.

The mine and flotation mill of Minerva Oil Co., both of which were brought into operation in March 1944, were operated throughout 1945, and output of flotation concentrates was double that of 1944. The company also milled a comparatively small tonnage of Mexican fluorspar; but the flotation concentrates so recovered, as well as shipped, are not included in the statistics for Illinois.

The Lead Hill and Stewart mines of the Fluorspar Products Co. were inactive most of 1945; in consequence, output declined sharply.

The Rose Creek and Douglas mines, operated by Yingling Mining Co., were worked at a greatly reduced rate in 1945. Its entire output was sold to local mills for treatment.

Kentucky.—Production of fluorspar in Kentucky has declined progressively since 1942. Output of finished fluorspar was 95,000 short tons in 1945. However, the production includes 600 tons of finished fluorspar recovered from milling some crude ore mined before 1945. Consequently, total mine production (expressed in terms of finished fluorspar) was 94,400 tons in 1945 compared with 107,900 tons in 1944. Shipments also declined; they amounted to 95,142 tons—a 16-percent decrease from 1944. The 1945 shipments comprised 81,563 tons to steel plants, 11,251 tons to glass, enamel, and hydrofluoric acid plants, 2,292 tons to iron foundries, nonferrous smelters, cement, ferro-alloy, and miscellaneous plants, and 36 tons to Canada. Of the 1945 shipments, 22,391 tons were shipped to consumers by river or river-rail compared with 27,746 tons in 1944.

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Output in Caldwell County was much less than in 1944, chiefly because the Eureka, Hollowell & Hobby, Hughett, and Senator mines, which furnished the bulk of the 1944 production, were nonproductive in 1945. Most of the small output in Caldwell County came from the Glass, Ray Hill, Tyree, and Williamson mines, and from tailings milled by Albert Melhman, who acquired and rehabilitated the Crook mill at Crider.

The major part of the 1945 output in Crittenden County came from a few mines—Bachelor, Big Four, Blue, Davenport, Keystone, Pigmy, and Tabb. Most of the remainder came from many smaller producing mines (including the Babb, Ball, Barnes, Cook, Eagle (Watson), Gilless, Henley, Hickory Cane, Hodge, Kelley, Krause, La Rue, Pogue, Reiter, Waddell, Watkins, and Yates) and from numerous prospects; some was reclaimed from waste dumps and old workings of abandoned mines.

The Eagle Fluor Spar Co. worked the Babb and Eagle (Watson) mines at a greatly reduced rate in 1945.

The United States Coal & Coke Co. was the largest producer of fluorspar in the United States in 1945; it produced 16 percent more finished fluorspar than in 1944, but shipments were only 2 percent greater. The output came chiefly from the company-operated Tabb mines, but some was from the Big Four mine owned by the company but operated by Perry & Loyd.

The Kentucky Fluor Spar Co. and affiliates shipped 25 percent more fluorspar than in 1944. The company operates a mill at Marion and, through its mining division (Roberts & Frazer), operated the C. R. Babb, Carr, Ellis, and Wright mines in Livingston County. About three-fourths of the company supply came from these mines and the remainder chiefly from the Gilless, Minerva, Nancy Hanks, and Watkins.

The Keystone mine of Inland Steel Co. was flooded by the high waters in March and made little production during the remainder of 1945. The company also produced some fluorspar at the Barnes and Guill mines; the Barnes mine in Crittenden County was acquired in 1945. Although the fluorspar from these mines is finished at the company mill at Rosiclare, Ill., production and shipments are credited in the statistics to Kentucky.

The Pigmy mine of the Pigmy Corp. (subsidiary of the Rosiclare Lead & Fluorspar Mining Co.) produced 16 percent less fluorspar than in 1944.

The Davenport mine and equipment of the National Fluorspar Co. were sold on January 16 to Davenport Mine, Inc. During the first 4 months of 1945 production was suspended or seriously hampered by water problems brought on by continual heavy rains, consequently output at this operation was 28 percent less than in 1944.

The Delhi Fluorspar Corp. produced less fluorspar at the Bachelor mine for the fourth successive year and made no output at the Eureka mine in Caldwell County in 1945. However, the company purchased both finished fluorspar and milling ore from many producers; its shipments were 16 percent less than in 1944.

Shipments of fluorspar by L. Conyer, operating the Yates mine and a mill, both near Marion, were 19 percent smaller than in 1944.

Conyer purchases both finished fluorspar and milling ore from many local producers, and most of his shipments came from these sources.

Crider Bros. Fluorspar Co. worked the Blue mine near Mexico and the Jameson mine near Lola, reclaimed fluorspar from the Blue dumps, and purchased some fluorspar from local producers. Its sales were 40 percent less than in 1944.

In Livingston County most of the output came from the C. R. Babb, Carr, Ellis, Guill, Jameson, Klondike, Lovelace, Mineral Ridge, Nancy Hanks, Old Silver, and Wright mines and from reworking the C. R. Babb, Klondike, and other tailings.

Output at the C. R. Babb, Carr, Ellis, and Wright mines of Roberts & Frazer was about the same as in 1944. E. W. Frazer reworked the tailings at the C. R. Babb and other mines and recovered a small quantity of fluorspar.

Production of gravel fluorspar at the Nancy Hanks mine, operated by W. V. Haynes, Jr. and Tinsley & Loyd, was 36 percent more than in 1944, but recovery of sand spar was 58 percent less.

Butler & Moodie continued to reclaim fluorspar from Klondike tailings, and Butler, Moodie & Craighead made a small output at the Old Silver mine before it was flooded in March.

The Mahoning Mining Co. continued development at its Klondike and Mineral Ridge mines near Smithland, in the course of which some ore was produced.

In the Central Kentucky district production and shipments of fluorspar declined to 1,040 and 1,097 tons, respectively (1,867 and 1,707 tons in 1944). Output from this district in 1945 came from the Faircloth mine in Woodford County near Wilmore and the "Lone Oak" mine near Harrodsburg and the Twin Chimney and Britton mines near Mundys Landing, all in Mercer County. The Britton, Faircloth, and Twin Chimney mines, as well as the Gobel Dean, in Mercer County near Talmage, were acquired in mid-1945 by the Gilbert & Hageman Co. A jig mill was completed at the Twin Chimney mine, and a shaft was being sunk at the Faircloth mine. The company production of fluorspar will be shipped by barge from Mundys Landing on the Kentucky River.

Production at the "Lone Oak" mine, operated by J. B. Towles, ceased in May, because of the low grade of the ore.

Nevada.—Shipments of fluorspar from Nevada (7,038 short tons) were 3 percent smaller than in 1944. Most of the 1945 total went to steel plants, but some was shipped to hydrofluoric acid and cement plants and to an iron foundry.

The chief producing mine in Nevada in 1945 was the Baxter in Mineral County, operated by V. S. Baxter; its production was 31 percent less than in 1944. The other producing mine was the Daisy in Nye County, operated by J. Irving Crowell, Jr., but its production was 70 percent more than in 1944. The Baxter mine has been described by Thurston.[10]

New Mexico.—Fluorspar production in New Mexico, which reached an all-time high in 1944 after an unbroken 8-year upward trend,

[10] Thurston, W. R., Preliminary Report on the Baxter Fluorspar Deposit near Broken Hills, Nev. Geol. Survey Strategic Minerals Investigations, Preliminary Rept. 3-196, 1946, 3 pp.

declined in 1945. Much of the loss was due to the fact that the flotation mill of Zuñi Milling Co. operated almost entirely on Mexican ore in 1945. Production of finished fluorspar totaled 14,400 short tons, a loss of 66 percent from 1944. In addition, some crude ore equivalent to 14,200 tons of finished fluorspar was mined but not milled in 1945. Thus, production (expressed in terms of finished fluorspar) totaled 28,600 tons in 1945 compared with 40,500 tons in 1944. The output came from Catron, Dona Ana, Grant, Luna, and Valencia Counties.

Shipments from New Mexico totaled 14,449 tons, a decline of 66 percent from the all-time high established in 1944.

The flotation mill of General Chemical Co. at Deming did not operate during the latter part of 1945; consequently, production of concentrates from domestic ore was 11 percent less than in 1944. The mill feed comprised ore from the company Spar Group and Sadler mines in Luna County and the Osmer mine in Grant County and purchased ore from local mines. In addition, the company milled some Mexican ore, but the concentrates so recovered and shipped are not included in the statistics for New Mexico. Virtually all the flotation concentrates produced were shipped to the hydrofluoric acid plants of the company.

The Zuñi Milling Co., which operates a flotation mill at Los Lunas, was the largest producer of fluorspar in New Mexico in 1945. However, the mill feed comprised ore chiefly from Mexico, and the concentrates so recovered and shipped are not included in the statistics for New Mexico. A small tonnage of domestic ore stocked at the mill was also treated in 1945. The company continued development at its mines near Grants in Valencia County, in the course of which some ore was mined; it also purchased milling ore from nearby producers. The flotation mill did not operate the last 4 months of 1945, and as a consequence production from both Mexican and domestic ore was 24 percent less in 1945 than in 1944.

The Grattan flotation mill at Deming, acquired on August 1, 1944, by Edgar J. Marston, who made substantial improvements in the plant, discontinued operating in April because of his inability to make a satisfactory ratio of concentration. The mill feed comprised ore from the Greenleaf and Sadler (Grattan) mines in Luna County and the Land Lease mine in Dona Ana County—all operated by Marston—and ore purchased from the Burro Chief mine in Grant County. The concentrates produced were shipped to hydrofluoric acid plants.

During October 1945 the Grattan mill was operated by I. S. James, who produced a small tonnage of flotation concentrates which were shipped to a hydrofluoric acid plant. The Sadler (Grattan) mine was operated from June to October and produced a small tonnage of metallurgical-grade fluorspar, which was shipped to steel plants.

The heavy-media-process plant at Gila, owned by the Office of Metals Reserve and operated for that agency by the International Minerals & Chemical Co., discontinued operating in January 1945; during the month it produced 255 tons of fluxing-gravel fluorspar, which was placed in the Government stock pile at Gila. However, the Office of Metals Reserve continued to purchase milling ore until June 30, when the depot was closed. The milling ore purchased in 1945 came from the Blue Bonny, Burro Chief, Clum, Demique, Foster, Great Eagle, and Lost Brother mines. The mill was put into operation on December 27, 1943; since that time it has produced 17,908 tons of fluxing-gravel fluorspar, all of which is in the Government stock pile at Gila. The mill has operated entirely on ore purchased locally; the total quantity purchased was 79,500 tons, of which 97 percent came from the Burro Chief, Clum, Great Eagle, and Huckleberry mines.

The flotation mill of Indian Metals Co. at Lordsburg was operated sporadically during 1945, and output was about half that of 1944. The mill feed was supplied by purchased ore from the Lost Brother, Money Maker No. 1, and Spar Hill mines in Grant County near Lordsburg.

At the Burro Chief mine near Tyrone, Grant County, operated by H. E. McCray, the 400-foot level was being opened, and a washing plant was completed. However, the washing plant did not solve the cleaning problem, and a jig plant was being installed. A substantial tonnage of milling ore and some fluxing-gravel fluorspar were produced and shipped in 1945.

The Mirabal mine near Grants, Valencia County, was operated by various producers in 1945; its output comprised fluxing-gravel fluorspar which was shipped to steel plants and milling ore which was sold to the Zuñi Milling Co. The nearby Keeney and Boyd mines also produced some milling ore which was sold to the Zuñi Milling Co.

The White Star, Oakland, and Universal fluorspar veins near Hot Springs, N. Mex., have been described by Rothrock.[11]

Texas.—Production and shipments (3,518 and 3,413 short tons, respectively) were each 28 percent less than the all-time high of 1944. Production was from the Eagle Mountains mine in Hudspeth County, near Van Horn, operated by the Western Fluorite Co. A bank of flotation cells was added to the mill in 1945.

The Gibbs mine in Burnet County near Burnet was being developed by W. J. McDaniel.

The flotation mill near El Paso, Tex., which was sold on October 19, 1944, to the Continental Milling Co. for milling ore from the Moll mine in Mexico, operated a few months in 1945, after which milling of ore was discontinued. The flotation concentrates recovered from milling Mexican ore, as well as shipped, are not included in the statistics for Texas.

Utah.—Production of finished fluorspar in Utah was 2,918 short tons in 1945 compared with 3,490 tons in 1944, an all-time high. Shipments declined to 2,973 tons (3,466 tons in 1944).

The chief producer in Utah was the Tintic Standard Mining Co., which operated its Cougar mine and concentrating mill in Beaver County near Milford until September 30, when operations were suspended on account of the termination of a sales contract with the

[11] Rothrock, H. E., Preliminary Report on the White Star, Oakland, and Universal Fluorspar Veins near Hot Springs, Sierra County, N. Mex.: Geol. Survey Strategic Minerals Investigations, Preliminary Rept. 3-190, 1945, 3 pp.

Office of Metals Reserve. Production of finished fluorspar by the company was 43 percent greater than in 1944. A tunnel was being driven at a lower level in the Cougar mine. The mine and mill have been described in Mining World.[12]

Fred Staats, operating the Staats mine in Beaver County near Lund, and George Spor & Sons, operating the "Spor" mine in Juab County near Delta, also contributed to the production in Utah, but the output of these operators was 31 and 72 percent less than in 1944. The Western Fluorite Co. and the Manassa Mining & Milling Co. made no production or shipments of fluorspar in 1945.

Washington.—At the Mitchem mine in Ferry County near Keller, where development was under way and a small heavy-media-process plant was under construction by the Western Minerals Co. in 1944, both units were brought into production in February 1945. The mine is still under development. Production of fluxing-gravel fluorspar was 169 short tons in 1945, most of which was shipped to steel plants.

FOREIGN TRADE

Imports.—Receipts of imported fluorspar into the United States established a new record of 100,725 short tons in 1945—a gain of 9 percent over 1944, the previous peak. Some of the imported fluorspar placed in bonded warehouses in 1944 was withdrawn during 1945.

Fluorspar imported for consumption in the United States was 103,133 tons—a gain of 18 percent over 1944. The imports in 1945 comprised 10,275 tons containing more than 97 percent calcium fluoride and 92,858 tons of lower grade. They were valued [13] at $2,156,458. The value assigned to the higher-grade foreign fluorspar averaged $24.80 a ton in 1945 and that to the lower grade $20.48. The cost to consumers in the United States also includes duty, loading charges, insurance, consular fee, and freight to consuming plants. The duty on fluorspar containing not more than 97 percent calcium fluoride is $5.625 a short ton and on fluorspar containing more than 97 percent calcium fluoride $3.75 a ton.

In 1945, as in 1944 and 1943, the bulk of the imported fluorspar was delivered to Government stock piles. However, 22,500 tons of imported fluorspar were milled in 1945 at flotation plants in the United States; and 16,486 tons of acid-grade, 433 tons of ceramic-grade, and 455 tons of metallurgical-grade fluorspar were recovered therefrom.

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[12] Mining World, Mining Utah Fluorspar—Tintic Standard's New Cougar Operation: Vol. 7, No. 8, 1945, pp. 25-27.

[13] As defined in sec. 402 of the tariff act of 1930, "The value of imported merchandise * * * is the foreign value or the export value, whichever is higher—that is, the market value or the price at which the merchandise, at the time of exportation to the United States, is offered for sale in the principal markets of the country from which exported, including the cost of containers or coverings and all expenses (including any export tax) incident to placing the merchandise in condition ready for shipment to the United States."

Fluorspar imported for consumption in the United States, 1944–45, by countries and customs districts

Country and customs district	Containing more than 97 percent calcium fluoride		Containing not more than 97 percent calcium fluoride		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1944						
Canada:						
Buffalo			65	$1,768	65	$1,768
Michigan			4	183	4	183
			69	1,951	69	1,951
Mexico:						
Buffalo			138	2,044	138	2,044
Chicago			46	1,462	46	1,462
El Paso	806	$20,315	20,161	217,350	20,967	237,665
Laredo	2,404	47,522	34,089	678,388	36,493	725,910
Michigan			374	8,349	374	8,349
Philadelphia			306	4,659	306	4,659
	3,210	67,837	55,114	912,252	58,324	980,089
Newfoundland: Philadelphia	2,352	85,613	13,720	345,619	16,072	431,232
Spain: Philadelphia			9,177	222,080	9,177	222,080
Union of South Africa:						
Maine and New Hampshire			249	4,399	249	4,399
Maryland			852	11,225	852	11,225
New York			818	7,540	818	7,540
Philadelphia			1,638	21,551	1,638	21,551
			3,557	44,715	3,557	44,715
United Kingdom: New York			1	37	1	37
	5,562	153,450	81,638	1,526,654	87,200	1,680,104
1945						
Canada: Buffalo			[1] 2,361	[1] 75,085	[1] 2,361	[1] 75,085
Mexico:						
Arizona			469	6,915	469	6,915
Chicago			4,080	65,472	4,080	65,472
El Paso	897	22,806	16,883	174,671	17,780	197,477
Laredo	5,279	106,114	33,299	648,242	38,578	754,356
Maryland			69	1,294	69	1,294
Michigan			1,265	23,331	1,265	23,331
Ohio			53	784	53	784
Philadelphia			281	5,063	281	5,063
	6,176	128,920	56,399	925,772	62,575	1,054,692
Newfoundland:						
Buffalo			[1] 1,288	[1] 26,468	[1] 1,288	[1] 26,468
Philadelphia	4,099	125,880	5,488	180,208	9,587	306,088
	4,099	125,880	[1] 6,776	[1] 206,676	[1] 10,875	[1] 332,556
Spain: Philadelphia			27,322	694,125	27,322	694,125
	10,275	254,800	92,858	1,901,658	103,133	2,156,458

[1] Bureau of Mines has determined that 1,691 tons, valued at $56,918, credited to Canada by the U. S. Department of Commerce, originated in Newfoundland.

The following table, compiled from data supplied the Bureau of Mines by importers and by domestic companies milling foreign fluorspar, shows the quantities of imported fluorspar delivered to consumers in the United States in 1944 and 1945, irrespective of year of importation into the United States; it differs from the preceding table, which shows the quantity and grade imported into the United States in 1944 and 1945. The quantities in the following table are based upon the actual outturn weights and include the finished fluorspar recovered from milling foreign ore rather than the ore milled.

Imported fluorspar delivered to consumers in the United States, 1944–45, by uses

Use	1944			1945		
	Short tons	Selling price at border, tidewater, or f. o. b. flotation mill in United States, including duty		Short tons	Selling price at border, tidewater, or f. o. b. flotation mill in United States, including duty	
		Total	Average		Total	Average
Steel	1,639	$42,804	$26.12	21,027	$555,530	$26.42
Hydrofluoric acid	5,907	208,067	35.22	22,579	811,025	35.92
Magnesium	224	6,419	28.66	60	2,100	35.00
Ferro-alloys	45	1,390	30.89	193	5,769	29.89
Glass and enamel				548	18,110	33.05
Other				125	4,625	37.00
	7,815	258,680	33.10	44,532	1,397,159	31.37

Exports.—Producers of fluorspar reported exports of 1,420 short tons of fluorspar valued at $45,939 in 1945 compared with 1,980 tons valued at $65,909 in 1944. The exports by producers in 1945 comprised 620 tons of ceramic ground and flotation concentrates to Canada; 401 tons of ground and flotation concentrates to Peru; 388 tons of flotation concentrates to Belgium; and 11 tons of ceramic ground to Brazil.

Fluorspar reported by producers as exported from the United States, 1941–45

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1941	12,184	$277,782	$22.80	1944	1,980	$65,909	$33.29
1942	9,016	242,545	26.90	1945	1,420	45,939	32.35
1943	9,044	246,973	27.31				

WORLD PRODUCTION

The following table shows world production of fluorspar by countries from 1937 to 1945, insofar as statistics are available.

World production of fluorspar, 1937–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945
Argentina (shipments)	350	1,406	739	597	2,027	2,328	4,000	(2)	(2)
Australia:									
New South Wales	55	-------	-------	-------	-------	-------	-------	(2)	(2)
Queensland	1,410	2,479	20	888	706	311	544	520	(2)
Victoria	-------	804	-------	-------	136	344	468	266	(2)
Canada	136	197	218	4,041	5,020	5,624	10,169	6,281	6,279
France	51,430	51,920	(2)	48,004	41,901	27,447	24,846	12,825	(2)
Germany:									
Anhalt	13,662	10,462	11,157	13,058	13,356	12,470			
Baden	13,637	21,350	22,480	24,249	27,256	31,625			
Bavaria	62,455	59,919	69,870	54,629	53,245	59,640			
Prussia	30,514	22,956	24,414	27,583	23,530	27,841	[3] 190,000	[3] 170,000	(2)
Saxony	8,074	12,063	10,002	9,931	10,940	11,806			
Thuringia	16,117	22,405	24,040	18,297	18,497	32,290			
India, British	-------	-------	20	(2)	(2)	(2)	(2)	(2)	(2)
Italy	13,385	12,186	13,243	16,320	20,905	35,034	(2)	(2)	(2)
Korea (Chosen)	8,084	[4] 34,207	[3] 22,000	27,217	[3] 30,000	47,847	[3] 50,000	[3] 60,000	(2)
Mexico (exports)	(2)	(2)	-------	9,271	10,521	5,365	22,469	56,450	50,251
Newfoundland	8,479	8,944	11,227	14,697	11,581	[3] 32,660	66,170	58,290	49,841
Norway	1,692	1,676	2,367	(2)	1,529	2,405	(2)	(2)	(2)
Southern Rhodesia	-------	156	-------	(2)	(2)	(2)	(2)	(2)	(2)
South-West Africa	-------	585	105	(2)	(2)	(2)	(2)	(2)	(2)
Spain	4,250	8,596	8,408	9,097	15,400	16,297	35,911	55,595	6,458
Switzerland	-------	-------	-------	-------	-------	486	582	520	(2)
Tunisia	1,676	2,060	2,541	873	(2)	(2)	16	-------	(2)
Union of South Africa	3,615	4,736	10,322	7,421	4,486	4,185	4,646	3,481	[5] 2,781
U. S. S. R	[3] 70,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United Kingdom	42,837	33,866	38,786	45,617	42,233	43,920	55,106	48,927	(2)
United States (shipments)	164,408	72,940	165,806	211,917	290,905	326,871	368,330	375,374	293,891
Total (estimate)	519,000	456,000	560,000	616,000	698,000	800,000	(2)	(2)	(2)

[1] In addition to countries listed China produces fluorspar, but data of output are not available.
[2] Data not available.
[3] Estimate.
[4] Exports.
[5] January to September, inclusive.

Canada.—According to the Dominion Bureau of Mines, production of fluorspar in Canada was 6,279 metric tons [14] (all from Ontario) in 1945 compared with 6,281 tons in 1944. In Canada output falls short of consumption, and the greater part of the deficiency is met by importations from Mexico, Newfoundland, and the United States. Imports in 1944 were 33,657 metric tons.

Germany.—The following information concerning the fluorspar industry in Germany is taken from a recent report: [15]

Germany has been for many years one of the leading producers and exporters of fluorspar, second only to the United States. In recent years the industry has been highly integrated, with control in the hands of four or five strong companies. Until the outbreak of war exports were maintained at 30,000 to 40,000 tons a year, about ⅓ of which was shipped to the United States. German consumption rose with the rapid expansion of the steel and aluminum industries from a few thousand tons in 1932 to 120,000 tons in 1938 and 180,000 tons in 1942.

[14] 1 metric ton is equivalent to 1.10231 short tons.
[15] Office of Military Government for Germany (U. S.), Non-Metallic Mineral Resources of Germany: Economic Division, Industry Branch, Coal and Non-Metallic Mining Section, Dec. 1, 1945, pp. 5–7.

Workable deposits of fluorspar are found in Bavaria, Thuringia, Anhalt, Prussia, Saxony and Baden, but the most productive mines are in the Stulln-Nabburg-Woelsendorf area of Bavaria and in the vicinity of Rottleberode in the Harz mountains. Third in importance are the deposits in the Thuringian Forest where under wartime demand a number of small mines together produced more than 30,000 tons a year.

The principal Bavarian mines are in a granite belt extending from Schwarzenfeld, some 20 kilometers northeast to Nabburg. In this district the fluorspar occurs in nearly vertical veins along shear zones in the granite, associated with barite and quartz. The Woelsendorf mine was the leading Bavarian producer with output of about 2,000 tons a month. At this mine two veins are developed by a shaft to a depth of 200 meters and over a length of 1,000 meters. Mine production was about 250 tons of ore per day from which about 80 tons of hand sorted lump, jig and flotation concentrates were recovered. A byproduct of lump barite also was recovered on the sorting table. The hand sorted lump and the jig concentrates contain 85 to 90 percent CaF_2 and are suitable for metallurgical flux used in the production of basic steel in Siemens-Martin or electric furnaces. Two flotation products were made; one containing 95 percent CaF_2 for the glass and enamel industry; and one containing 98 percent CaF_2 (acid grade) for making hydrofluoric acid used in the manufacture of artificial cryolite (sodium aluminum fluoride) and other fluorine compounds.

The oldest fluorspar mining district is in the Harz mountains in the vicinity of Rottleberode and Siptenfelde. Here fluorspar was first mined in the sixteenth century for use as a flux in the smelting of copper ores mined and smelted near Mansfeld and Eisleben. The fluorspar occurs in veins, quite commonly associated with barite which constitutes an important co-product at many of the mines.

Before and during the war expansion of the steel industry and establishment of an aluminum industry in Germany greatly increased the demand for metallurgical and acid grade fluorspar which together probably account for 80 percent or more of total consumption. Under this stimulus the less productive fields in Thuringia, Saxony and Baden were exploited to the fullest extent and production rose to 176,000 tons in 1942.

In 1934 Germany produced 71,000 tons of fluorspar and exported 31,000 tons. In the intervening years before the war exports remained at about the same level (30,000 to 40,000 tons a year) but production rose rapidly in step with the industrial expansion that accompanied the re-armament program. Steel plants were the chief consumers, and the growing demand from this source was augmented by expanding use of fluorine compounds and hydrofluoric acid, particularly in the manufacture of artificial cryolite for aluminum production. The supply from Greenland, the only source of natural cryolite, was sure to be cut off in time of war; hence the establishment of facilities for the manufacture of artificial cryolite was an essential preparatory measure, since maintenance of aluminum production was likewise an absolute necessity.

The productive capacity of fluorspar mines is divided among the zones of occupation approximately as follows:

American Zone	50 percent
British Zone	None
Russian Zone	42 percent
French Zone	8 percent

Virtually no war damage was sustained by the Bavarian mines. The extent of damage, if any, in the other producing districts is not known. In general, small mines and plants remote from industrial areas were not strategic targets and any damage was incidental to fighting in the vicinity and likely to be of a nature easily repaired.

Production during the war probably approached 200,000 tons a year. It seems a fair assumption that present capacity is not less than 75 percent of that amount, or 150,000 tons annually. It is understood that reserves are not large but would be sufficient to maintain that rate of production for 10 to 20 years.

Presumably no more aluminum will be produced in Germany, and the level of steel production will be only a fraction of wartime output. Under these conditions domestic requirements would not exceed 50,000 to 60,000 tons annually, and production at full capacity would provide an exportable surplus of around 100,000 tons a year, which is doubtless more than could be disposed of. It appears feasible to produce any quantity for export that may be needed. Stocks are believed to be small and not available for export unless the mines are reopened and production resumed.

The names, locations, and approximate capacities of the principal fluorspar mines (in the United States zone) are listed below.

Mine	Location	Capacity, tons per year
Rheinfluss	Sulzbach a. D., Bavaria	4,000
Schmerstalle.n	do	20,000
Barbaraschacht u. Johannesschacht	Woelsendorf, Bavaria	(1)
Woelsendorf	do	23,000
Marienschacht	do	(1)
Stulln	Stulln, Bavaria	(1)
Eberhard	do	(1)
Erna	do	4,000
Erika	Schwarzenfeld, Bavaria	8,000
Marienzeche	do	(1)
Gisela, Centa, Fortuna, Gustav	Lissenthan, Bavaria	(1)
Doppenschmidt	Pforzheim, Baden	(1)
Lichtenberg	Lichtenberg, Bavaria	1,800
Roland	Nabburg, Bavaria	6,000
Anna	do	(1)
Pfeiffer u. Co.	do	5,000
Helene	do	6,000
Edward	Freihung, Bavaria	3,000
Caecilia	do	16,700

[1] Not stated.

Mexico.—Formerly a small producer, Mexico has become an important one, as indicated by exports of 50,251 metric tons in 1945 and exports of 56,450 tons in 1944. The bulk of the exports went to the United States, but some went to Canada. Some ore from the Moll mine was milled at the flotation mill near El Paso, Tex., in 1945. The mill was operated by the Continental Milling Co., which discontinued milling operations there in the early part of 1945.

Newfoundland.—The St. Lawrence Corp. of Newfoundland, Ltd., which has a gravity-concentrating mill and a flotation mill for treating the ore from its mines, and Newfoundland Fluorspar, Ltd. (a subsidiary of the Aluminum Co. of Canada, Ltd.), which ships crushed fluorspar from its mine to Arvida, Quebec, where it has a flotation plant, were the only producers in Newfoundland in 1945. Operations of both producers were adversely affected by the end of hostilities, since which time Newfoundland Fluorspar, Ltd., has suspended production and the St. Lawrence Corp. of Newfoundland, Ltd., has curtailed operations. Chiefly for this reason, production declined to 49,841 metric tons in 1945 from 58,290 tons in 1944. The output of the St. Lawrence Corp. was shipped to the United States and Canada. The flotation concentrate produced from ore mined by Newfoundland Fluorspar, Ltd., is used by the Aluminum Co. of Canada, Ltd., at Arvida, but some ore was exported in 1945.

Spain.—Chiefly as a result of demand by Germany and the United States, production of fluorspar in Spain increased from an average of 7,509 metric tons annually during the 5 years 1936–40 to 55,595 tons in 1944. The defeat of Germany and discontinuance of preclusive buying by the United States resulted in a phenomenal decline in production to 6,458 tons in 1945. The following information on Spanish fluorspar mines is taken from a report by Bennett.[16]

The most important fluorspar mines in Spain are in Asturias near Gijon and Ribadesella. These mines are capable of producing metallurgical spar of 89–91 percent CaF_2, with 5 percent silica, in considerable quantity. There is also a modern flotation plant capable of producing about 50 tons per day of acid grade. All these mines are close to tidewater, that is, within 30 or 40 km. (19 to 25 mi.) of the ship loading point.

There is a mine in Cordoba, the Fuenteovejuna, capable of producing acid lump. It has a freight rate of 65 pesetas [17] a ton to shipping points at Huelva or Seville, however.

There are two mines in Catalonia, the Osor and the Papiol, of somewhat questionable value, but should be investigated in any general study of Spanish fluorspar. The Osor mine has a good flotation plant and may be able to produce acid grade. Altogether, there is little doubt that the Spanish mines can produce 50,000 to 60,000 tons per year, including possibly 10,000 tons of acid spar between lump and flotation concentrates.

Collada mine 15 km. (9 mi.) south of Gijon, Asturias. Reserves are between 50,000 and 100,000 tons. Ore is clean with only silica gangue. Ore can be shipped as mined, at 89–91 percent CaF_2 with maximum 7 percent SiO_2. There is a gravity washing plant capable of treating 3,000 tons per month. The maximum depth worked is 60 meters (197 feet). There is a 5 km. (3 mi.) aerial tramway to the railway at Langreo, whence ore is shipped 20 km. (12 mi.) to Gijon for loading on ship. This mine was producing 2,000 tons monthly in 1944. A flotation plant to serve this mine has been built at Pinzales, 10 km. (6 mi.) from Gijon, of about 50 tons daily capacity, with the idea of shipping acid spar. It has never been used.

Pilar, Pie de Potro mine, 16 km. (10 mi.) west of Ribadesella, Asturias. High grade product, with some barite. Was producing 300–400 tons a month in 1944. Superficially developed.

Caravia mine near the Pilar. Has had some production but is relatively undeveloped.

Papiol mine near Barcelona in Barcelona Province. An old lead mine which has been worked at times for fluorspar pockets. Not considered promising.

Felguerosa mine. Adjoins Collada, 15 km. (9 mi.) south of Gijon, Asturias Province. Reserves estimated at 40,000 tons. Was producing 250 tons per month in 1944. Ore is hand-sorted and hand-jigged to produce a product of 90 percent CaF_2.

Dosal mine near the Pilar mine, west of Ribadesella. Reserves estimated at 50,000 tons. Was shipping 1,000 tons monthly in 1944 of 92–93 percent CaF_2 and 9 percent silica. Open pit and shallow underground workings.

Fuenteovejuna mine, Cordoba Province, 75 km. (47 mi.) northwest of Cordoba. It is described as a 5-meter (16-foot) vein, but is probably a replacement deposit. Similar to the Asturias deposits. It produces acid grade lump, hand-sorted. The freight rate of 65 pesetas to seaport is a heavy burden but it operates profitably. No estimate of reserves. Open pit workings.

Berbes mine, near Ribadesella in Asturias. No estimate of reserves. Was producing 500 tons a month of metallurgical spar in 1944. Superficially developed.

Osor mine, 20 km. (12 mi.) west of Gerona in Gerona Province, northeast of Barcelona. Deposits are extensive and well-developed by Germans, who planned to export acid spar to Germany. Has a recently-completed flotation plant. Ore is complicated by inclusions of lead, zinc, and barite, which are removable by flotation and leaching, but the process is undoubtedly expensive. Also, the mine is 75 km. (47 mi.) from the nearest port, San Felix de Guixols, and 115 km. (71 mi.) from Barcelona.

[16] Bennett, Evan, minerals attaché, American Embassy, Madrid, July 6, 1945, 4 pp.
[17] At the rate of exchange in February 1946, a peseta was equivalent to 9.13 cents.

CRYOLITE

Imports of cryolite were 17,952 long tons valued at $1,349,678 in 1945 compared with 15,680 tons valued at $1,155,787 in 1944. Except for 2 tons and a few hundred pounds, respectively, from Canada in 1945 and 1944, the cryolite imported in both years came from Greenland.

Exports of cryolite were 1,697 long tons valued at $420,592 in 1945 compared with 950 tons valued at $226,087 in 1944.

Cryolite occurs in commercial quantity and is mined at only one place—Ivigtut, Greenland. Gibbs [18] has described the mine at Ivigtut, the grades of ore produced, methods of processing and purification, and various uses of cryolite.

Artificial cryolite was manufactured in the United States in 1945 by the Aluminum Ore Co. at East St. Louis, Ill. Production was 4 percent less than in 1944. Plants for the manufacture of artificial cryolite were completed in 1943 at Bauxite, Ark., and Cornwells Heights, Pa., but neither has been operated.

The chief use of cryolite is in the reduction of aluminum; comparatively small quantities are used in glass, enamels, abrasives, and insecticides.

[18] Gibbs, A. E. (technical director, Pennsylvania Salt Manufacturing Co.), Cryolite as a Chemical Raw Material: Chem. Ind., vol. 38, May 1936, pp. 471–476.

FELDSPAR

By Robert W. Metcalf and A. B. Holleman

SUMMARY OUTLINE

SUMMARY

Paced by the accelerated demand for glass and glass products, a continued high level of pottery sales, and the increasing market for enameled ware, the production of both crude and ground feldspar in 1945 broke all previous records by substantial margins. Tonnages of crude and ground feldspar in 1945 rose 10 and 8 percent, respectively, above those in the former peak year for each (1941), while the values of the crude and ground spar sold were 11 and 10 percent, respectively, higher than in 1944, the former record year in realization for both. Production of "aplite" decreased only slightly from the peak output in 1944. Imports of Canadian crude feldspar were the highest since 1930, and imports of unground nepheline syenite (also from Canada) reached record levels, 20 percent greater than in the former peak year 1943.

Salient statistics of the feldspar industry in the United States, 1943–45

	1943	1944	1945	Percent of change in 1945
Crude feldspar:				
Domestic sales:				
Long tons	308, 180	327, 408	373, 054	+13. 9
Value	$1, 646, 277	$1, 813, 937	$2, 021, 529	+11. 4
Average per long ton	$5. 34	$5. 54	$5. 42	—2. 2
Imports:				
Long tons	10, 758	11, 686	14, 924	+27. 7
Value	$83, 073	$95, 956	$114, 917	+19. 8
Average per long ton	$7. 72	$8. 21	$7. 70	—6. 2
Ground feldspar:				
Sales by merchant mills:				
Short tons	335, 810	343, 201	381, 728	+11. 2
Value	$3, 591, 960	$3, 863, 036	$4, 246, 961	+9. 9
Average per short ton	$10. 70	$11. 26	$11. 13	—1. 2
Imports:				
Short tons	41	10	----------	—100. 0
Value	$417	$203	----------	—100. 0
Average per short ton	$10. 17	$20. 30	----------	----------

The output of crude feldspar in practically all the chief producing States was larger in 1945 than in 1944. Production in North Carolina rose 21 percent in tonnage and 11 percent in value to a new record. The output of crude spar in Virginia also rose 21 percent. Colorado and Maine in 1945 had high proportionate gains over 1944. Sales of ground feldspar in North Carolina in 1945 topped production in other individual States for the first time since 1936, and the output of North Carolina and Tennessee combined increased in quantity and value by more than one-quarter compared with 1944. Production of ground feldspar at southern mills and in South Dakota showed large increases in 1945 compared with 1944 in contrast to the decreases (mostly moderate) in New England States and western producing areas other than South Dakota.

Although the over-all value of glass products decreased, probably, for the most part, on account of the curtailed output of plate glass in the latter part of the year, most of the other market indicators reflecting activity in the glass trades and other industries consuming sizable quantities of feldspar showed healthy increases. Production and shipments of glass containers, perhaps the largest single market for feldspar, were 6 and 11 percent, respectively, higher in 1945 than in 1944 and were accompanied by a 14-percent drop in inventories at the end of 1945 compared with the end of 1944. Manufacturers' sales of machine-made table, kitchen, and household glassware rose approximately 10 percent, and production and shipments of automatic tumblers increased in 1945 compared with 1944. The comparatively small yet significant jump in privately financed residential building in 1945 also is of interest to feldspar producers, as well as the 13-percent increase in the value of sales of porcelain enamel products. The first 4 months of 1946 have seen substantial gains in production, shipments, and value over the corresponding periods in 1945 in most market outlets for feldspar. Barring the effects of strikes and shortages of equipment and material, the general business recovery and specifically the expected large housing and commercial building programs should react directly and favorably upon the feldspar industry.

DOMESTIC PRODUCTION

Following the usual practice in the industry, crude feldspar is reported in long tons of 2,240 pounds and ground feldspar in short (net) tons of 2,000 pounds.

Crude feldspar.—Production of crude feldspar in 1945 continued at an accelerated pace and topped all previous records in both quantity and value. The total output rose to 373,054 long tons valued at $2,021,529, or 10 percent higher in tonnage than in 1941, the former high year, and 11 percent higher in value than the previous highest realization (in 1944). The 1945 output was 14 percent above that for 1944.

Output in practically all the important producing States in 1945 showed at least small increases. The fairly large gains in production over 1944 were not confined to one section of the country but affected both eastern and western mining areas impartially.

Crude feldspar sold or used by producers in the United States, 1941–45

[Value at mine or nearest shipping point]

Year	Long tons	Value		Year	Long tons	Value	
		Total	Average			Total	Average
1941	338,860	$1,519,456	$4.48	1944	327,408	$1,813,937	$5.54
1942	316,166	1,546,702	4.89	1945	373,054	2,021,529	5.42
1943	308,180	1,646,277	5.34				

Feldspar was mined in 13 States in 1945, the same States as in 1942, 1943, and 1944. North Carolina in 1945 again produced a record tonnage with a record realization—148,493 long tons valued at $863,740, or 21 percent higher in tonnage and 11 percent higher in value than in 1944, the previous peak year. The output in Virginia increased 21 percent. Connecticut had a small gain in 1945 over 1944. Production in Maine rose 37 percent, although output still was considerably under 1941 and most prior years. New Hampshire, whose figures may not be shown, increased its output in 1945 compared with 1944. Production in South Dakota, the second largest producer, increased 6 percent. Colorado showed the largest percentage increase of any State (66 percent). Output in Wyoming, which markets practically all its crude spar to mills in Colorado, declined by nearly one-quarter in 1945 compared with 1944. Decreases (mostly small) occurred in Arizona, California, New York, and Pennsylvania.

Crude feldspar sold or used by producers in the United States, 1943–45, by States

[Value at mine or nearest shipping point]

State	1943		1944		1945	
	Long tons	Value	Long tons	Value	Long tons	Value
Arizona	(1)	(1)	(1)	(1)	(1)	(1)
California	(1)	(1)	(1)	(1)	(1)	(1)
Colorado	20,659	$88,691	15,787	$81,967	26,279	$105,021
Connecticut	11,618	76,463	11,390	75,394	11,705	74,778
Maine	6,748	41,652	8,011	47,892	10,974	62,287
New Hampshire	(1)	(1)	(1)	(1)	(1)	(1)
New York	(1)	(1)	(1)	(1)	(1)	(1)
North Carolina	112,144	656,182	122,857	778,007	148,493	863,740
Pennsylvania	(1)	(1)	(1)	(1)	(1)	(1)
South Dakota	70,913	342,643	64,806	288,188	68,374	314,787
Texas	(1)	(1)	(1)	(1)	(1)	(1)
Virginia	20,550	122,957	24,010	147,106	29,089	178,664
Wyoming	(1)	(1)	22,415	81,770	17,021	62,614
Undistributed [2]	65,548	317,689	58,132	313,613	61,119	359,638
	308,180	1,646,277	327,408	1,813,937	373,054	2,021,529

[1] Included under "Undistributed."
[2] Includes States indicated by "(1)."

Quotations on crude feldspar do not appear in the trade press. However, average realizations by States have been computed from the questionnaires returned to the Bureau of Mines each year from mineral producers. According to these producers, the average sales realization per long ton for crude spar in 1945 was \$5.42—2 percent less than in 1944—and, except for 1944, was the highest since 1934. Average realizations in most States were somewhat higher in 1945 than in 1944. Decreases in realization were noted in five States—Colorado, Connecticut, Maine, New York, and North Carolina. Averages per ton for certain States in 1944 and 1945 (1944 in parentheses) follow: North Carolina, \$5.82 (\$6.33); Virginia, \$6.14 (\$6.13); Connecticut, \$6.39 (\$6.62); Maine, \$5.68 (\$5.98); Colorado, \$4 (\$5.19); and South Dakota, \$4.60 (\$4.45).

Ground feldspar.—Sales of ground feldspar by merchant mills in 1945 totaled 381,728 short tons valued at \$4,246,961 and established records in both tonnage and value. Sales in 1945 were 11 percent higher in quantity than in 1944 and 8 percent higher than the former peak sales of ground spar in 1941. The value of sales in 1945 was 10 percent greater than in the previous high year (1944). In the New England States and in Western States other than South Dakota, production of ground feldspar was less in 1945 than in 1944. Output from southern mills showed large gains. North Carolina and Tennessee mills combined supplied 37 percent of the total sales of feldspar ground in the United States in 1945 compared with 32 percent in 1944, 30 percent in 1943, and 26 percent in 1942. Sales of feldspar of Canadian origin ground in merchant mills in the United States were only 2 percent of total merchant sales in 1945, as in 1943 and 1944, compared with 3 percent in 1942 and slightly higher percentages in preceding years, such as 6 percent in 1937 and 1936. In addition to the amounts just mentioned, relatively small tonnages of Canadian origin are ground by consumers, principally pottery and cleanser manufacturers, who import their spar direct and whose figures are not included in these compilations.

Ground feldspar sold by merchant mills [1] *in the United States, 1941–45*

Year	Active mills	Domestic			Canadian			Total	
		Short tons	Value		Short tons	Value		Short tons	Value
			Total	Average		Total	Average		
1941	29	347,092	\$3,646,404	\$10.51	7,325	\$136,199	\$18.59	354,417	\$3,782,603
1942	29	318,209	3,339,462	10.49	9,577	185,507	19.37	327,786	3,524,969
1943	27	329,354	3,465,885	10.52	6,456	126,075	19.53	335,810	3,591,960
1944	28	335,491	3,714,039	11.07	7,710	148,997	19.33	343,201	3,863,036
1945	30	372,377	4,062,077	10.91	9,351	184,884	19.77	381,728	4,246,961

[1] Excludes potters or others who grind for consumption in their own plants.

For the first time since 1936, North Carolina topped all States in the production of ground feldspar in 1945, followed by South Dakota, Tennessee, New Hampshire, and Colorado. Output in North Carolina and Tennessee combined rose in 1945 to 142,208 short tons valued at \$1,665,634, or 29 percent in tonnage and 26 percent in value greater than in 1944. New Jersey and Connecticut combined showed a 13-percent drop in tonnage, as did Maine, while output in Colorado decreased 9 percent and that in California 32 percent. Substantial gains in the production of ground spar, however, were reported for South Dakota and Virginia and a small increase for New York. In other States, for which figures cannot be given, small to moderate decreases were noted.

Ground feldspar sold by merchant mills [1] in the United States, 1943–45, by States

State	1943			1944			1945		
	Active mills	Short tons	Value	Active mills	Short tons	Value	Active mills	Short tons	Value
Arizona	1	(2)	(2)	1	(2)	(2)	1	(2)	(2)
California	2	(2)	(2)	3	1,188	$17,688	3	809	$11,911
Colorado	3	39,326	$271,854	3	45,365	318,696	3	41,433	307,619
Connecticut	1	20,780	365,483	1	22,079	409,875	2	19,139	355,578
New Jersey	3			3			2		
Illinois	1	(2)	(2)	1	(2)	(2)	1	(2)	(2)
Maine	2	(2)	(2)	2	11,184	178,049	2	9,746	156,618
New Hampshire	2	(2)	(2)	2	(2)	(2)	3	(2)	(2)
New York	3	(2)	(2)	3	(2)	(2)	3	(2)	(2)
North Carolina	3	100,157	1,181,600	3	110,251	1,326,861	4	142,208	1,665,634
Tennessee	2			2			2		
South Dakota	2	(2)	(2)	2	(2)	(2)	2	(2)	(2)
Virginia	2	(2)	(2)	2	(2)	(2)	2	(2)	(2)
Undistributed [3]		175,547	1,773,023		153,134	1,611,867		168,393	1,749,601
	27	335,810	3,591,960	28	343,201	3,863,036	30	381,728	4,246,961

[1] Excludes potters or others who grind for consumption in their own plants.
[2] Included under "Undistributed."
[3] Includes items indicated by "(2)."

The average realization per short ton for ground feldspar in 1945 declined slightly to $11.13; except for 1944, however, this was the highest since 1938 ($11.50). In all States except Illinois, New York, and Virginia, the percentages of change from 1944 to 1945 varied from less than 1 to 6 percent. The average realization for New York increased slightly more than 6 percent, that for Virginia declined at a somewhat higher rate, and in Illinois remained unchanged. Realizations in Colorado, Maine, New Hampshire, South Dakota, and New Jersey-Connecticut were higher in 1945 than in 1944. Other States were less in 1945 than in 1944. Average values per short ton for individual States in 1945 ranged from $7.42 to $18.58. Average realizations for ground spar for selected States in 1945 follow: Colorado, $7.42; South Dakota, $7.98; North Carolina-Tennessee, $11.71; New Hampshire, $11.90; Maine, $16.07; and New Jersey-Connecticut, $18.58.

According to E&MJ Metal and Mineral Markets, quotations on ground feldspar in 1945 were the same as in the years immediately preceding. Potash and soda feldspars, in bulk, f. o. b. North Carolina or Maine, 200-mesh, white, were quoted at $17 and $19, respectively. Granular glass spar, f. o. b. North Carolina, 20-mesh, white, in bulk, was quoted at $12.50 per ton and semigranular glass spar at $11.75. Quotations on Virginia feldspar, as given by the same journal, were: No. 1, 230-mesh, $18; 200-mesh, $17; glassmakers' spar No. 18, $12.50; and No. 17, $11.75. Ground feldspar for enamelers' use ranged from $14 to $16 per ton, f. o. b., on either a Spruce Pine, N. C., or Keene, N. H., basis.

CONSUMPTION AND USES

Crude feldspar.—Most crude feldspar is sold to merchant mills, which may obtain their requirements from several mines or localities. The raw spar is stock-piled, sorted according to grade and source, blended, and ground to specified fineness, perhaps run through magnetic separators or put through a flotation machine, and sold to ultimate consumers. However, a few pottery and enamel manufacturers purchase part or all of their feldspar crude and grind it in their own mills. Certain makers of soap, cleansers, and sweeping compounds also mine or purchase crude feldspar, largely from New England, Virginia, and North Carolina, and after grinding or otherwise processing it utilize the abrasive properties of the spar in their products. Some Canadian crude spar also is purchased direct by consumers in this country. Manufacturers of artificial teeth annually consume a small tonnage of very carefully selected crude material, which must be free of all grit and is sold at a considerable premium over the No. 1 grade commercial feldspar.

Ground feldspar.—Sales of ground feldspar to ceramic industries in 1945 were 99 percent of total shipments compared with 98 percent in 1944. By far the bulk of the ground spar consumed is sold to glass and pottery manufacturers. Shipments to the glass industry in 1945 rose to 249,927 short tons, a record tonnage, 13 percent larger than the previous high in 1944. Sales to potteries also were at a high level and were 5 percent higher in 1945 than in 1944. Sales to glass plants rose to about 66 percent of total shipments in 1945 compared with 64 percent in 1944. Although there was an actual increase in tonnage of ground spar sold to potteries in 1945 compared with 1944, the percentage of pottery sales to total sales declined 2 percentage points. Sales to glass and pottery manufacturers in 1945 were 53 and 41 percent, respectively, of the total value, compared with 51 and 43 percent in 1944. Sales of enamel spar rose 63 percent in 1945 compared with 1944. Although still very much under prewar years, this increase heralds the recovery of that industry from its war-time lows. Sales of ground feldspar for use in soaps, cleansers, and abrasives decreased by about one-third in 1945 compared with 1944. The remainder of the ground feldspar sold by merchant mills in 1945 (much less than 1 percent of total shipments) was consumed in miscellaneous ceramic applications other than glass, pottery, or enamel and for various other uses, the nature of which was not specified.

Ground feldspar sold by merchant mills in the United States, 1943–45, by uses

Use	1943		1944		1945	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Ceramic:						
Glass	214,668	63.9	220,734	64.3	249,927	65.5
Pottery	97,887	29.2	106,341	31.0	111,695	29.3
Enamel	7,147	2.1	8,464	2.5	13,755	3.6
Other ceramic uses	1,261	.4	849	.2	1,747	.4
Soaps and abrasives	9,481	2.8	6,424	1.9	4,245	1.1
Other uses	5,366	1.6	389	.1	359	.1
	335,810	100.0	343,201	100.0	381,728	100.0

Ground feldspar shipped from merchant mills in the United States, 1941–45, by destinations, in short tons

Destination	1941	1942	1943	1944	1945
California	10,444	12,224	8,669	9,788	8,735
Illinois	44,573	50,450	49,302	49,434	53,114
Indiana	39,620	38,998	40,873	40,057	47,321
Maryland	(1)	8,745	9,028	7,593	9,411
Massachusetts	(1)	3,630	3,855	3,508	3,258
New Jersey	44,249	43,029	40,259	38,158	35,735
New York	18,326	18,363	18,024	21,886	19,005
Ohio	52,270	43,950	42,536	41,208	48,151
Oklahoma	(1)	8,002	(1)	(1)	(1)
Pennsylvania	54,534	40,013	36,190	47,803	47,217
Tennessee	9,697	3,507	2,677	4,983	8,881
West Virginia	29,916	35,161	48,940	45,658	58,653
Wisconsin	10,517	7,837	8,718	7,993	7,058
Other destinations [2]	40,271	13,877	26,739	25,132	35,189
	354,417	327,786	335,810	343,201	381,728

[1] Included under "Other destinations"; separate figure for State not available.
[2] Includes Arkansas, Colorado, Connecticut, District of Columbia, Hawaii, Kentucky, Louisiana, Maryland (1941), Massachusetts (1941), Michigan, Minnesota, Mississippi, Missouri, Oklahoma (1941, 1943–45), Puerto Rico, Rhode Island, South Carolina, and Texas and other States (shipments to which cannot be segregated), also small shipments to Belgium, Canada, England, and Mexico.

TECHNOLOGIC DEVELOPMENTS

The exhaustion of the more readily available deposits of the better grades of feldspar and the shortage of labor for hand-picking high-grade feldspar suitable for glass and various ceramic products, with the accompanying rise in cost of mining, have encouraged the development and adaptation of flotation methods to the refining of this mineral. Alaskite, granite, syenite, and other similar abundant rocks can readily be used in place of relatively scarce smaller deposits of comparatively pure feldspar. Costly hand-picking would be curtailed, as the impurities would be removed mechanically in the flotation process. Large quarrying operations might replace, to a certain extent, at least, the present small-scale mining, resulting in lower extraction costs. One large flotation mill already is in production in North Carolina, a second plant is being built in North Carolina, and another company (in New Hampshire) has been seriously considering operation of a similar mill. In the process, small quantities of long-chain amines and hydrofluoric acid are employed as flotation agents [1] in the so-called Steffensen air flotation machine.[2]

Direct substitution of soda spar for potash spar on a pound-for-pound basis in semivitreous dinnerware resulted in no significant change in properties except perhaps lowered crazing resistance, according to Loomis and Blackburn.[3] Where crazing occurs, a slightly lower thermal expansion in the regular glaze was suggested as a corrective. In sanitary porcelain and similar vitreous whiteware bodies, equal amounts of soda spar did not produce as effective vitrification as with the straight potash-feldspar bodies in current use, and modification of the glaze to fit the soda-feldspar bodies probably would be required. To facilitate feeding without dust and to aid in

[1] Engineering and Mining Journal, vol. 147, No. 2, February 1946, p. 103.
[2] Work cited in footnote 1, p. 106.
[3] Loomis, George A., and Blackburn, A. R., Use of Soda Feldspar in Whiteware Bodies: Am. Ceram. Soc. Jour. and Ceram. Abs., vol. 29, No. 2, Feb. 1, 1946, p. 48.

clean storage of glassmaking materials, a method of nodulating the conventional glass batch has been devised.[4] Utilization of feldspar as a screening aid in the washing of small sizes of coal in Great Britain was claimed to have resulted in a heavy reduction of ash content in the cleaned products.[5]

OTHER DEVELOPMENTS

Northern Feldspars, Inc., was operating its new mill near West Rumney, N. H., in 1945. The Interstate Feldspar Corp., was reported to have built a grinding mill during 1945 at Dillsboro, N. C. The Feldspar Milling Co., Burnsville, N. C., also is understood to be planning the erection of a milling plant near Bryson City, N. C. A detailed description of the Bedford, Va., plant of the Carolina Mineral Co., Inc., which produces glass spar, was given by Swanson.[6] The extraction of usable feldspar concentrates from southeast Missouri granite was studied by the Missouri Geological Survey.[7] It is understood that treatment of anorthosite in Wyoming to obtain alumina and a dicalcium silicate residue suitable for the production of low-alumina, high-silica cement has not yet proved feasible.[8]

Feldspar (and quartz) has been mined on a small scale since 1931 near Bangalore, Mysore, India, for use in a Government-owned porcelain factory. Difficulties of exploitation are set forth, and the discovery of other large feldspar resources is mentioned.[9] Mining of feldspar in the Transvaal in the Union of South Africa has supplied the scouring-powder industry with an abrasive material since 1943.[10] Feldspar from this area also has been used in a small way in glass manufacture and in ceramics. In addition to small-scale mining of feldspar in Egypt and in Palestine, potash-feldspar deposits are known in Iran.[11]

NEPHELINE SYENITE

Nepheline syenite is a quartz-free crystalline rock consisting principally of nephelite (an alumina-potash-soda silicate) and albite and microcline feldspars. Often associated are the iron-bearing minerals, black mica and magnetite, and accessory minerals such as zircon, corundum, and others. Its high alumina content (20 to 30 percent compared with 17 to 20 percent in most commercial feldspars) has made it especially desirable in the manufacture of glass. Continued research has broadened possible applications to other branches of ceramics, such as pottery, sanitary and electrical porcelain, floor and wall tile, glazes, and related uses. Its most active market, however, is the manufacture of glass and glass products.

Except for Russia, whose output is not known, Canada is said to be the only commercial producer of nepheline syenite. The American

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[4] Bair, George J. (assigned to Norbert S. Garbisch), U. S. Patent 2,366,473, Jan. 2, 1945; Chem. Abs., vol. 39, No. 9, May 10, 1945, p. 1970.

[5] British Coal Utilization Research Association, Problems in the Utilization of Small Coals: 1944, pp. 23–27. Washing of Small Coal on Feldspar Wash-Boxes with Automatic Shale Discharge: 1944, pp. 229–232; Chem. Abs., vol. 39, No. 18, Sept. 20, 1945, pp. 4210–4212.

[6] Swanson, H. E., Feldspar Processing for Glass: Rock Products, vol. 48, No. 9, September 1945, pp. 62–63, 65.

[7] Engineering and Mining Journal, vol. 147, No. 4, April 1946, p. 131.

[8] Work cited in footnote 1, p. 99.

[9] Mining Journal (London), Feldspar in Bangalore: Vol. 225, No. 5736, July 28, 1945, p. 482.

[10] South African Mining and Engineering Journal, vol. 55, pt. II, Oct. 14, 1944.

[11] Mining Journal (London), vol. 226, No. 5768, Mar. 9, 1946, p. 187.

Nepheline Corp., at its large plant in Rochester, N. Y., prepares glass and pottery grades and smaller quantities for enamel manufacture. Raw material was obtained from the quarries of American Nepheline, Ltd., at Blue Mountain, Methuen Township, Peterborough County, southeastern Ontario. After preliminary tests and semiplant investigations, the Rochester mill was changed over to flotation separation to eliminate the objectionable impurities, chiefly corundum. Port Coldwell Mines & Metals, Ltd., which also owns a nepheline property on the northern shore of Lake Superior at Port Coldwell, plans erection and operation of a mill at its more recently acquired deposits near Bancroft, Hastings County, eastern Ontario.

Undeveloped deposits of nepheline syenite are reported in the French River area, Georgian Bay district, Ontario; in the Montreal and Labelle-Annonciation areas, Quebec; and in the Ice River district, near Field, British Columbia. The Russian deposits on the Kola Peninsula in northern European Russia (U. S. S. R.) are worked on a large scale for the recovery of the phosphate (apatite), with nephelite as a byproduct. Russian experiments also contemplate the treatment of nepheline for the recovery of alumina.[12] In the United States, nepheline syenite in Arkansas recently has been investigated to determine the possibilities of this substance as a raw material for ceramics. The experiments are chiefly directed toward reduction below 1 percent of the approximately 6 percent iron content inherent in the rock as mined.[13]

The larger part of the Canadian output is shipped in crude form to the mill at Rochester, N. Y., ground, and marketed to consumers in the United States. Imports of crude nepheline syenite in 1945 rose to 51,785 short tons valued at $194,975 and were the highest yet recorded—20 percent in quantity and 30 percent in value larger than in 1943, the previous peak year. Receipts of ground nepheline syenite totaled 1,073 short tons valued at $11,461, the largest reported since 1941. All imports of crude and ground material have originated in Canada.

Nepheline syenite imported for consumption in the United States, 1941–45

Year	Crude		Ground		Year	Crude		Ground	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1941	35,799	$112,101	1,359	$13,695	1944	39,043	$136,664		
1942	35,990	120,688	4	44	1945	51,785	194,975	1,073	$11,461
1943	43,105	150,225	737	7,680					

Quotations on crude nepheline syenite are not reported in the trade press; however, average values per short ton (estimated foreign market value) of imports for consumption in the United States in recent years were as follows: 1941, $3.13; 1942, $3.35; 1943, $3.49; 1944, $3.50; and 1945, $3.77. During both 1944 and 1945, ground nepheline syenite was quoted by Oil, Paint and Drug Reporter as follows (prices

[12] Talmud, I. L., Strokov, F. N., and Musyakov, V. A., Alumina from Nepheline: Russian Patent 56,544, Feb. 29, 1940; Chem. Abs., vol. 36, 1942, p. 3015; Am. Ceram. Soc. Jour. and Ceram. Abs., vol. 29, No. 1, Jan. 1, 1946, p. 12.

[13] Work cited in footnote 7, p. 132.

are per short ton in bulk, f. o. b. Rochester, N. Y.): Glass-grade, 24-mesh, $12 per ton; pottery-grade, 200-mesh, $15.50 per ton. Packed in bags, prices are $2 higher.

APLITE

Shipments of ground "aplite" in 1945 showed a small decline in both tonnage and value compared with 1944. Virtually the entire production of aplite is consumed in the manufacture of glass, particularly glass containers, with quite small amounts used for enamel. Figures, however, may not be published, as to do so would reveal operations of individual firms. Calcining at temperatures ranging from 1,650° to 2,000° F. facilitates the reduction of the aplite to a grain size suitable for use in ceramic ware or for similar purposes.[14]

Two companies mine and process aplite: Dominion Minerals, Inc., Washington, D. C. (the first company to commence mining), and Carolina Mineral Co., Erwin, Tenn., an affiliate of the Consolidated Feldspar Corp., Trenton, N. J. Both firms operate mills near Piney River, Va.

IMPORTS [15]

Feldspar.—Imports for consumption of crude feldspar in the United States in 1945 amounted to 14,924 long tons, valued at $114,917—28 percent greater in tonnage than in 1944 and the highest in both quantity and value since 1930. The 1945 receipts, however, were only slightly more than half the average annual imports during the 5 or 6 years (1924–29) preceding 1930. No ground feldspar was imported in 1945. All the crude spar received came from Canada.

Feldspar imported for consumption in the United States, 1941–45

Year	Crude		Ground		Year	Crude		Ground	
	Long tons	Value	Short tons	Value		Long tons	Value	Short tons	Value
1941	11,253	$73,236			1944	11,686	$95,956	10	$203
1942	9,525	69,798			1945	14,924	114,917		
1943	10,758	83,073	41	$417					

Cornwall stone.—Imports for consumption of unmanufactured Cornwall stone in 1945 totaled 838 long tons valued at $11,317, or 81 percent in tonnage and 77 percent in value greater than in 1944. Receipts, however, were much less than in 1940 and 1941. Average value in 1945 declined to $13.50 per long ton. No ground Cornwall stone was imported in 1945. All imports have originated in the United Kingdom.

[14] Brenner, R. F. (assigned to Dominion Minerals, Inc.), Treating the Rock, Aplite: U. S. Patent 2,387,561, Oct. 23, 1945 (March 26, 1943); Am. Ceram. Soc. Jour. and Ceram. Abs., vol. 29, No. 1, Jan. 1, 1946, p. 19.

[15] Figures on imports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Cornwall stone imported for consumption in the United States, 1941–45

Year	Unmanufactured		Ground		Year	Unmanufactured		Ground	
	Long tons	Value	Long tons	Value		Long tons	Value	Long tons	Value
1941	2,736	$31,138	182	$2,658	1944	463	$6,394	10	$225
1942	74	1,021	5	92	1945	838	11,317		
1943	392	5,591	20	442					

WORLD PRODUCTION

The United States produces by far the major portion of the world's reported output of feldspar. Sizable quantities have been mined in normal years in Canada, Finland, Norway, Sweden, Germany (Bavaria), Czechoslovakia, France, Italy, and China. In South America, Argentina and Brazil have reported production. Indicating the widespread occurrence of feldspar and the increasing tendency toward development of local nonmetallic mineral resources, production has been reported during the last 3 or 4 years from a number of other countries, including Spain, United Kingdom, Northern Ireland, Palestine, Madagascar, and Uruguay.

World production of feldspar, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Argentina (shipments)	620	1,051	1,220	2,981	5,622	2,000	(2)	(2)
Australia:								
New South Wales [3]	178	51	64	452	1,469	3,890	4,756	(2)
South Australia [3]	502	615	1,072	1,081	1,026	522	818	(2)
Western Australia	2,919	3,853	3,561	4,173	3,304	2,351	1,990	1,254
Canada (shipments)	12,753	11,306	19,464	23,623	20,203	21,644	21,327	25,444
Egypt	199	74	138	52	19	20	50	40
Finland (exports)	5,046	5,596	(2)	(2)	(2)	(2)	(2)	(2)
Germany: Bavaria	10,419	11,436	12,762	12,973	12,332	(2)	(2)	(2)
India, British	702	501	999	1,257	2,100	1,340	(2)	(2)
Italy	13,391	12,473	(2)	12,758	(2)	(2)	(2)	(2)
Madagascar	(2)	(2)	(2)	(2)	9	2	34	(2)
Northern Ireland	(2)	(2)	(2)	(2)	(2)	(2)	172	(2)
Norway	27,013	24,288	6,782	7,527	6,269	[4] 4,861	[4] 7,108	[4] 1,579
Palestine	(2)	(2)	(2)	(2)	(2)	85	65	(2)
Rumania	1,690	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain	(2)	(2)	(2)	(2)	4,251	1,093	2,567	(2)
Sweden	45,111	40,792	22,222	(2)	(2)	(2)	(2)	(2)
United Kingdom	(2)	(2)	(2)	(2)	(2)	10	203	(2)
United States (sold or used)	199,267	257,534	295,430	344,299	321,240	313,126	332,663	379,042
Uruguay	(2)	(2)	(2)	(2)	(2)	(2)	264	(2)

[1] In addition to countries listed, feldspar is produced in Brazil, China (Manchuria), Czechoslovakia, France and Union of South Africa. Official figures of Czechoslovakian output are not available, but it is estimated that the annual production is approximately 30,000 metric tons (Stat. Comm. Czechoslovak Ceram. Soc.).
[2] Data not available.
[3] Includes some china stone.
[4] Exports.

ASBESTOS

By Oliver Bowles and Dorothy I. Marsh

SUMMARY OUTLINE

SUMMARY

Asbestos production in the United States in 1945 experienced a substantial gain over 1944. As in previous years, most of the domestic output consisted of the shorter grades of chrysotile mined in Vermont. Production in 1945 totaled 13,590 short tons compared with 7,558 tons in 1944, a gain of 80 percent. Domestic sales reached 12,226 short tons, a gain of 83 percent over 1944. The domestic producing industry furnished only 3 percent of total consumption in the United States during 1945.

Canada furnished a large part of the United States requirements of shingle stock, paper stock, and other of the nonspinning grades. Africa supplied a substantial part of longer grades that were of great importance in the military program and will continue in strong demand under peacetime conditions. Woven friction materials, particularly for automotive manufacture, and packings and gaskets employed in power-generating plants are among the important uses of the long fibers.

Amosite asbestos, used extensively in making 85-percent magnesia and other high-temperature molded insulation, is obtained only in South Africa. Blue asbestos (crocidolite), an important use of which is for making asbestos-cement pipe, is obtained chiefly in South Africa, although small quantities sometimes originate in Australia.

Tremolite asbestos, which is of value for filtering chemicals, was mined in Maryland for many years until the deposit was exhausted. Production has now shifted to California and Alaska.

There were no serious interruptions to imports of fiber either from Africa or Canada in 1945; accordingly, adequate supplies were available for military and essential industrial needs and to build up a stock pile as a reserve. With cessation of major military operations during the latter part of 1945, the situation was so favorable that all special canvasses conducted by the War Production Board were discontinued, and steps were taken to liquidate a large part of the

Government stock pile, which was no longer regarded as necessary. Early in 1946, 3,000 tons of C & G3 and 1,400 tons of C & G4 (Rhodesian grades of chrysotile) were sold to the French Raw Materials Mission; and 1,500 tons of C & G3 and 4,000 tons of C & G4 to the Belgian Purchasing Mission. The Government stock pile is, therefore, almost depleted. At the end of 1945 there was a world shortage of shingle and paper grades of asbestos. As the building program attains increasing volume, the shortage will probably become more acute.

Salient statistics for asbestos in 1944 and 1945 are summarized in the following table.

Salient statistics of the asbestos industry in the United States, 1944–45

	1944		1945	
	Short tons	Value	Short tons	Value
Domestic asbestos—				
Produced:				
Chrysotile	[1] 7,166	(2)	13,340	(2)
Amphibole	[1] 392	(2)	250	(2)
Total produced	7,558	(2)	13,590	(2)
Sold or used by producers:				
Chrysotile	[1] 6,275	[1] $373,112	11,986	$413,359
Amphibole	[1] 392	[1] 7,222	240	3,989
Total sold or used by producers	6,667	380,334	12,226	417,348
Imports (unmanufactured)	383,049	18,542,940	374,199	16,284,915
Exports (unmanufactured)	475	58,983	8,550	837,175
Apparent consumption [3]	[1] 389,241	[1] 18,864,291	377,875	15,865,088
Exports of asbestos products	(2)	5,614,243	(2)	7,264,087

[1] Revised figure.
[2] Figures not available.
[3] Quantity sold or used by producers, plus imports, minus exports.

The following table shows domestic production of asbestos during recent years according to varieties.

Asbestos sold or used by producers in the United States, 1941–45, by varieties

Year	Chrysotile		Amphibole		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	22,439	$707,589	1,952	$18,164	24,391	$725,753
1942	13,373	480,245	2,108	18,612	15,481	498,857
1943	3,900	302,289	2,114	32,526	6,014	334,815
1944	[1] 6,275	[1] 373,112	[1] 392	[1] 7,222	6,667	380,334
1945	11,986	413,359	240	3,989	12,226	417,348

[1] Revised figure.

DOMESTIC INDUSTRY

REVIEW BY STATES

Alaska.—Tremolite asbestos was again produced in the Dahl Creek area, Kobuk River district. A small quantity of long slip-fiber chrysotile also was produced. The deposits of both varieties were worked by the Arctic Circle Exploration Co., Candle, Alaska.

Arizona.—The Arizona Chrysotile Asbestos Co. of Globe continued to be the largest producer in the State. Arthur Enders produced both spinning and short fibers at the Reynolds Falls mine about 50 miles from Globe, Gila County. The Globe Los Angeles Mining Co. (address 724 S. Spring St., Los Angeles 14, Calif.) recovered short fiber from the waste dumps of the Canadian mine in Gila County. Guy Phillips of Globe and John A. Bacon of Roosevelt also produced in Gila County. The entire production of Arizona was of the chrysotile variety. Sales were considerably greater than in 1944.

The mill of Pine Top Asbestos Mines, financed by the Defense Plant Corporation, has been acquired by the Globe Asbestos Co. and is said to have begun production in January 1946.

California.—The Powhatan Mining Co. (Woodlawn, Baltimore, Md.) produced tremolite asbestos near Castella and Hazel Creek (Sims), Shasta County—shipping point, Dunsmuir. Homer E. Fenn also reported sales of tremolite from a deposit near Hazel Creek. Kohler & Chase shipped short-fiber chrysotile from the mine near Monticello, Napa County, but did not produce. Sales in 1945 were considerably smaller than in 1944.

Georgia.—The only producer in Georgia in 1945 was the Powhatan Mining Co. from its amphibole asbestos property near Dillard, Rabun County.

North Carolina.—A deposit of amphibole asbestos in Macon County not far from Dillard, which is over the line in Georgia, was worked by the Powhatan Mining Co. of Woodlawn, Baltimore, Md.

Vermont.—The Vermont Asbestos Mines Division of the Ruberoid Co. (500 5th Ave., New York 18, N. Y.) is operating both the new quarry 1 mile from the mill, and the old quarry close to the mill site. Both mill and quarries were operated most of the time throughout the winter of 1945–46, as well as during the summer months, but production was limited by a serious shortage of labor. The long fiber obtained in the new quarry has not yet been adapted to spinning purposes but is being prepared as a high-grade shingle fiber. Most of the output is short-fiber chrysotile. Production was far below plant capacity but was, nevertheless, much greater than in 1944.

TRENDS IN CONSUMPTION

Domestic consumption of unmanufactured asbestos and the value of exports of asbestos products for a 10-year period are indicated in the accompanying table. The value of asbestos products manufac-

Raw asbestos consumed in and asbestos products exported from the United States, 1936–45

Year	Raw asbestos—apparent consumption (short tons)	Asbestos products—exports (value)	Year	Raw asbestos—apparent consumption (short tons)	Asbestos products—exports (value)
1936	250,922	$2,479,273	1941	438,741	$4,835,194
1937	316,263	3,047,078	1942	433,919	5,116,919
1938	187,150	2,533,916	1943	445,902	4,877,864
1939	255,547	3,354,920	1944 [1]	389,241	5,614,243
1940	262,199	3,473,248	1945	377,875	7,264,087

[1] Revised figures.

tured in the United States has not been compiled by the Bureau of the Census since 1939.

The building industry furnishes an extensive market for asbestos-cement, heat-insulating, and fireproofing products; accordingly, consumption trends of asbestos should correspond in general with trends in the construction industries. Power plants and industrial organizations also provide substantial markets for asbestos in the form of gaskets, packings, boiler lagging, pipe covering, and friction materials. The market requirements for such products may therefore be measured approximately by the volume of industrial production. These relationships are brought out in figure 1, in which asbestos consumption is plotted against total new construction and industrial production.

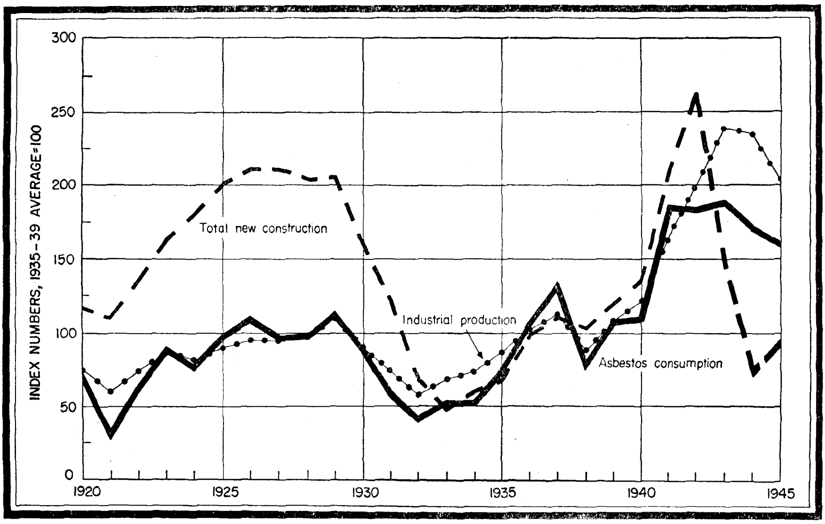

FIGURE 1.—Consumption of asbestos compared with total new construction and industrial production, 1920–45. Units are reduced to percentages of the 1935–39 average. Statistics on value of construction from Bureau of Foreign and Domestic Commerce and on industrial production from Federal Reserve Board.

CONSUMPTION ACCORDING TO USE

The Bureau of Mines has, for the first time, conducted a canvass of asbestos consumption by uses, but the returns are too incomplete and interpretation of the figures too complex to permit incorporation in this chapter. The figures will appear separately at a later time.

MARKET CONDITIONS

Although the Canadian mines were operating virtually at capacity and imports from Africa were uninterrupted, market demands threatened to exceed supply. Demands for spinning fibers eased somewhat during the early months of 1945 but became stronger toward its close. Decreased requirements because of canceled war orders were more than compensated by demands from liberated countries for crudes and spinning and shingle fibers. Moreover, there was an increasing demand for fibers of the latter category to supply the needs of new asbestos-cement industries recently established in several countries. A definite shortage of both spinning and shingle fibers had developed at the end of the year.

PRICES

Prices of asbestos as quoted in E&MJ Metal and Mineral Markets were unchanged throughout the year, as follows:

Per ton, f. o. b. Quebec mines, tax and bags included: Crude No. 1, \$650–\$750; crude No. 2 and sundry crudes, \$165–\$385; spinning fibers, \$124–\$233; magnesia and compressed sheet fibers, \$124–\$146.50; various grades shingle stock, \$62.50–\$85; various grades paper stock, \$44–\$49; cement stock, \$28.50–\$33; floats, \$19.50–\$21; shorts, \$14.50–\$26.50. Quotations in United States currency.

Per ton, f. o. b. Hyde Park, Vt.; Shingle fiber, \$62.50–\$65.50; paper-stock fiber, \$44–\$53; waste, \$33; shorts, \$14.50–\$28.50; floats, \$19.50.

NEW DEVELOPMENTS

Several new asbestos products have been perfected lately, among them an asbestos paper as thin as cigarette paper. Because of its excellent binding properties, its low moisture absorption, and its resistence to moderately high temperatures asbestos has a promising future for use in combination with plastics. Amosite asbestos has been suggested as a satisfactory substitute for kapok used in life jackets.

The new asbestos quarry and mill of the Compania Minas de Cemento de Tinaquillo, near Tinaquillo, Venezuela, began operation in 1945. A factory for making cement-asbestos products now under construction at Caracas will use the shorter fibers, and an export trade for the longer fibers will be sought.

FUTURE OUTLOOK

The largest tonnages of asbestos are used in the building trades. Asbestos-cement products in the form of flat and corrugated sheeting, wallboard, millboard, lumber, and roofing shingles are finding wider application at this time because of a lumber shortage. As the building program enlarges during 1946, the demands for such products will so increase that shortage of cement-stock fibers is forecast. Important accessories to the building trades are heat-insulation materials, such as pipe and boiler covering. Eighty-five percent magnesia pipe covering and block insulation, air-cell pipe covering made of asbestos paper, cements, and other insulating products will doubtless be in heavy demand to supply the needs of new industrial units, as well as many new public and private building projects.

A strong demand is in prospect also for the longer fibers applied to textile use. The revivified automobile industry will demand large quantities of woven brake linings and clutch facings, and many woven packings and gaskets will be needed to satisfy the requirements of industrial and power plants. There will, of course, be a tremendous decline in demand for cable coverings, other Navy uses, and friction materials for army mobile equipment and aircraft, but it is believed that industrial and construction needs will more than compensate for these losses.

The rehabilitation of asbestos products industries in foreign countries is an important factor in the raw materials situation. In most of the countries where such plants exist, there are no asbestos-producing industries. The supplies of raw materials must originate in the long-established centers of production, namely Canada, Africa, and Soviet Russia. This condition threatens to increase further the danger of a shortage of supply of certain grades. The U. S. S. R. is a large asbestos producer, but with growing industrialization it seems unlikely that large quantities of Russian fiber will be made available to world markets.

FOREIGN TRADE [1]

The following table shows imports of unmanufactured asbestos into the United States in 1944 and 1945. Total imports declined 2 percent in quantity and 12 percent in value. The larger proportional decline in value is due to a falling off in imports of crudes and high-grade mill fibers and an increase in imports of low-priced short fibers. Imports from Africa declined greatly. Imports from the U. S. S. R. were about the same in 1945 as in 1944, but the fiber received in 1945 was of higher grade.

Asbestos (unmanufactured) imported for consumption in the United States, 1944–45 by countries and classes

Country	Crude (including blue fiber)		Mill fibers		Short fibers		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1944								
Africa:								
Southern Rhodesia	7,966	$1,522,825					7,966	$1,522,825
Union of South Africa	19,196	1,859,982					19,196	1,859,982
Bolivia	15	1,905					15	1,905
Canada	1,528	564,545	145,791	$9,757,627	205,928	$4,720,939	353,247	15,043,111
Chile	14	1,118					14	1,118
U. S. S. R.			2,610	113,390			2,610	113,390
United Kingdom			1	609			1	609
	28,719	3,950,375	148,402	9,871,626	205,928	4,720,939	383,049	18,542,940
1945								
Africa:								
Southern Rhodesia	2,545	531,501					2,545	531,501
Union of South Africa	13,247	1,363,434					13,247	1,363,434
Australia	2	162					2	162
Canada	780	293,858	137,734	9,105,325	217,254	4,813,867	355,768	14,213,050
Cuba	11	1,975					11	1,975
U. S. S. R.	2,625	174,183					2,625	174,183
United Kingdom	1	610					1	610
	19,211	2,365,723	137,734	9,105,325	217,254	4,813,867	374,199	16,284,915

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

The following table shows imports and exports of unmanufactured asbestos for the 5-year period 1941–45.

Asbestos (unmanufactured) imported for consumption in and exported from the United States, 1941–45

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1941	419,196	$17,909,077	4,846	$325,825
1942	419,242	21,217,650	774	134,411
1943	440,255	23,053,524	367	36,856
1944	383,049	18,542,940	475	58,983
1945	374,199	16,284,915	8,550	837,175

The following table shows exports of asbestos products in 1944 and 1945. The value of exports shows a gain of 29 percent.

Manufactured asbestos products exported from the United States, 1944–45, by kinds

Product	1944		1945	
	Quantity	Value	Quantity	Value
Brake lining:				
Molded and semimolded short tons	1,035	$1,467,692	1,093	$1,580,652
Not molded linear feet	321,019	193,443	353,028	236,099
Clutch facing number	1,412,544	567,653	1,360,846	555,995
Paper, millboard, and roll board short tons	773	121,137	754	136,019
Pipe covering and cement do	1,730	264,349	1,825	213,468
Textiles, yarn, and packing do	1,085	1,346,407	1,665	1,994,297
Asbestos roofing squares	59,580	438,800	119,770	676,898
Other asbestos manufactures, except roofing short tons	5,353	957,536	6,047	1,208,100
Magnesia and manufactures do	1,266	257,226	9,131	662,559
	----------	5,614,243	----------	7,264,087

WORLD PRODUCTION [2]

Production of asbestos throughout the world, by countries, from 1938 to 1945, insofar as figures are available, is indicated in the following table.

World production of asbestos, 1938–45, by countries, in metric tons [1]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	---	110	150	84	51	(2)	(2)	(2)
Australia:								
New South Wales	---	---	9	38	142	422	353	(2)
South Australia	49	46	119	152	64	11	6	(2)
Tasmania	4	---	---	4	7	19	105	(2)
Western Australia	123	279	370	62	121	247	313	(2)
Bolivia	21	[3] 2	[3] 71	[3] 211	[3] 58	[3] 22	[3] 13	[3] 61
Brazil	120	45	500	[3] 13	(2)	(2)	(2)	(2)
Canada (sales) [4]	262, 894	330, 642	313, 504	433, 492	398, 669	423, 831	380, 349	423, 557
China	(2)	(2)	100	(2)	(2)	(2)	(2)	(2)
Cyprus (exports)	5, 668	10, 377	9, 673	4, 874	3, 503	1, 332	(2)	(2)
Egypt	---	---	---	---	---	7	240	[5] 50
French Morocco	---	---	---	---	116	182	507	(2)
Greece	85	(2)	(2)	(2)	(2)	(2)	(2)	(2)
India, British	90	266	251	372	514	293	(2)	(2)
Italy	6, 860	6, 765	8, 269	10, 766	11, 695	[6] 7, 419	(2)	(2)
Japan (approximate)	1, 000	1, 000	1, 000	(2)	(2)	(2)	(2)	(2)
Kenya Colony	5	(2)	(2)	213	307	321	341	(2)
Madagascar	---	---	---	3	11	(2)	3	(2)
New Zealand	---	---	---	54	43	190	17	(2)
Southern Rhodesia	53, 352	52, 900	[3] 52, 518	[3] 49, 191	[3] 56, 546	[3] 51, 149	52, 882	51, 118
Spain	---	---	---	2	84	50	---	(2)
Swaziland	---	7, 233	18, 873	19, 166	23, 219	17, 179	29, 628	(2)
Switzerland	---	---	---	---	6	11	7	(2)
Turkey	668	88	99	146	295	133	231	(2)
Uganda	53	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Union of South Africa	21, 025	20, 003	24, 849	[7] 25, 655	31, 351	32, 346	31. 372	[5] 19, 796
U. S. S. R	86, 000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
United States (sold or used by producers)	9, 471	14, 024	18, 198	22, 127	14, 044	5, 456	6, 048	11, 091
Venezuela	(2)	(2)	20	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed asbestos is produced in Algeria, Bulgaria, Czechoslovakia, Finland, France, Indochina, and Korea (Chosen).
[2] Data not available.
[3] Exports.
[4] Exclusive of sand, gravel, and stone (waste rock only), production of which is reported as follows: 1938, 2,975 tons; 1939, 3,535 tons; 1940, 5,880 tons; 1941, 7,669 tons; 1942, 7,339 tons; 1943, 6,272 tons; 1944-45, data not available.
[5] January to September, inclusive.
[6] January to June, inclusive.
[7] Preliminary.

CANADA

Production of asbestos in the Thetford Mines area of the Province of Quebec in 1945 was 11 percent greater than in 1944 and was only 2 percent less than in the peak year 1941. Production of crude fiber continues to decline. The extensive program of underground mining by the block-caving method undertaken by Canadian Johns-Manville is progressing satisfactorily, and production from stopes may begin within a year.

To the three United States asbestos-products manufacturers that have asbestos mines and mills in Quebec is to be added a fourth—Flintkote Mines, Ltd., a subsidiary of the Flintkote Co., 4111 R. C. A. Building, New York 20, N. Y. This firm has purchased an asbestos property a few miles north of Thetford Mines.

The figures for 1945 in the following table have been released by the Department of Mines of the Province of Quebec.

[2] Statistics compiled by B. B. Waldbauer.

Sales of asbestos in Canada, 1944–45, by grades

	1944			1945		
	Short tons	Value		Short tons	Value	
		Total	Average per ton		Total	Average per ton
Grade:						
Crudes	1,547	$621,956	$402.04	978	$412,557	$421.84
Fibers	190,233	14,305,966	75.20	219,767	16,628,467	75.66
Shorts	227,485	5,691,594	25.02	246,149	5,761,487	23.41
	419,265	20,619,516	49.18	466,894	22,802,511	48.84
Rock mined	7,778,805			(1)		
Rock milled	6,587,740			(1)		

[1] Data not available.

AFRICA

Southern Rhodesia.—No figures for Rhodesian asbestos production were published from 1940 to 1944, but export data, which are available for those years, are a fair measure of production because local consumption is quite small. As indicated in the following table, production data are now available for 1944 and 1945. Exports for 1944 were 46,755 short tons valued at £1,627,187.

Asbestos exported from or produced in Southern Rhodesia, 1940–45

Year	Short tons	Value	Year	Short tons	Value
1940	[1] 57,891	£1,419,566	1943	[1] 56,382	£1,827,387
1941	[1] 54,224	1,419,405	1944	[2] 58,293	(3)
1942	[1] 62,332	1,811,042	1945	[2] 56,348	(3)

[1] Exports. [2] Production. [3] Data not available.

Swaziland.—Chrysotile production in Swaziland is increasing greatly. As indicated in the preceding table of world production, output in 1944 was 28 percent greater than in 1942, the year of highest production up to 1944.

Union of South Africa.—Data for the first 9 months of 1945 show that both production and exports for the Union were considerably lower than in any year since 1941. Available data on exports and production, by Provinces, are given in the following table.

Asbestos produced in and exported from the Union of South Africa, 1940–45

Year	Production (short tons)				Exports	
	Transvaal	Cape Province	Natal	Total	Short tons	Value
1940	21,011	6,381	(1)	27,392	43,482	£934,417
1941	[2] 21,704	[2] 6,576	(1)	[2] 28,280	43,588	990,756
1942	27,278	7,281	(1)	34,559	55,223	1,348,977
1943	27,768	7,888	(1)	35,656	50,182	1,256,902
1944	26,747	7,835	(1)	34,582	[3] 28,203	[3] 673,735
1945 [4]	15,516	6,305	(1)	21,821	[3] 17,710	[3] 452,100

[1] Data not available.
[2] Partly estimated.
[3] Subject to revision.
[4] January to September, inclusive.

Four varieties of asbestos are marketed in the Union. Amosite, the principal variety, is produced only in the Transvaal. Crocidolite (blue asbestos) is mined in both the Transvaal and Cape Provinces. Because of depletion of the Amianthus mine chrysotile production in the Transvaal has declined greatly since 1937. The following table shows the tonnage of each variety produced, by Provinces, during recent years.

Asbestos produced in the Union of South Africa, 1940–45, by varieties and sources, in short tons [1]

Variety and source	1940	1941 [2]	1942	1943	1944	1945 [3]
Amosite (Transvaal)	17,767	19,211	24,924	23,189	22,848	13,067
Chrysotile (Transvaal)	646	1,658	1,917	2,034	2,014	1,412
Blue (Transvaal)	2,520	776	360	2,456	1,831	1,037
Blue (Cape)	6,381	6,576	7,281	7,888	7,835	6,305
Anthophyllite (Transvaal)	78	59	77	89	54	----------
	27,392	28,280	34,559	35,656	34,582	21,821

[1] Data from Union of South Africa, Department of Mines, Quarterly Report.
[2] Partly estimated.
[3] January to September, inclusive.

OTHER COUNTRIES

Statistics of the Russian asbestos industry have not been available for several years. Egypt, French Morocco, Turkey, and Kenya Colony have recently become small producers. The Cyprus industry is active, but statistics of production or exports since 1943 are not now available.

BARITE, WITHERITE, AND BARIUM CHEMICALS

By Charles L. Harness and F. M. Barsigian [1]

SUMMARY OUTLINE

SUMMARY

New records were established in all important phases of the barite industry in 1945. Domestic production reached 692,330 short tons, 34 percent higher than the previous 1944 record. Consumption of domestic and imported barite was reported as 720,903 tons, 21 percent greater than during the prior high year, 1944. Arkansas and Missouri mills grinding for the Gulf well-drilling trade were mainly responsible for the unprecedented output of ground barite, the national total being 468,939 short tons as against 344,757 for 1944, the previous record year.

On the other hand, decreases were noted in shipments of barium chemicals and lithopone, largely owing to shortages of crude barite and labor in eastern plants.

New deposits were opened in California, Nevada, and Missouri, while capacity of existing plants was expanded in Arkansas and Missouri. The only regularly producing State which did not report an increase was Tennessee.

The distribution of consumption of barite in the United States in 1945 was reported as follows (1944 in parentheses): For well drilling, 407,871 short tons (277,792); for chemicals, 99,173 (100,921); for lithopone, 139,288 (134,597); for glass, 25,761 (24,153); for paint filler, 21,000 (23,000); for rubber filler, 10,000 (10,000); and for other purposes, including grinding losses, 17,810 (25,100); total, 720,903 (595,563).

The Bureau of Mines prepared a circular of general interest concerning barite.[2]

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

[2] Harness, C. L., and Barsigian, F. M., Mining and Marketing of Barite: Bureau of Mines Inf. Circ. 7345, 1946, 78 pp.

SALIENT STATISTICS

The term "Crude (primary) barite" in the following table applies to barite as first offered to the trade, whether lump, crushed, or ground. The figure thus includes ground barite from Malvern, Ark., and El Portal, Calif., and lump barite from washers, open pits, and underground workings. Where ground barite has been reported to the Bureau as original production, an estimate of the value of the crude equivalent of the ground was assigned to such tonnage.

Although the apparent new supply of barite—752,956 short tons—was some 32,000 tons greater than reported consumption in 1945, this indicated merely an attempt to accumulate normal stocks rather than an excess of production or imports. The excess of consumption over new supply during the war years was not balanced even so, for there remained an annual average deficit of 2,600 tons consumption over new supply for the 5-year period 1941–45.

Salient statistics of the barite, witherite, and barium-chemical industries in the United States, 1941–45

	1941	1942	1943	1944	1945
Barite:					
Crude (primary):					
Produced short tons	483,391	449,873	429,298	515,136	692,330
Sold or used by producers:					
Short tons	503,156	429,484	420,343	518,617	696,062
Value: [1]					
Total	$3,134,234	$2,673,002	$2,796,776	$3,558,489	$5,348,652
Average	$6.23	$6.22	$6.65	$6.86	$7.68
Imports for consumption:					
Short tons	456	4,680	----------	67,888	56,894
Value: [2]					
Total	$2,518	$34,756	----------	$459,664	$382,611
Average	$5.52	$7.43	----------	$6.77	$6.72
Apparent new supply [3] short tons	503,612	434,164	420,343	586,505	752,956
Domestic percent	99.9	98.9	100	88.4	92.4
Reported consumption (total) short tons	490,833	449,424	453,744	595,563	720,903
Ground (and crushed):					
Sold by producers: [4]					
Short tons	234,877	178,765	208,252	344,757	468,939
Value	$4,606,832	$3,611,745	$3,743,919	$5,455,835	$7,519,759
Imports for consumption:					
Short tons	----------	----------	----------	11,964	1
Value	----------	----------	----------	$243,917	$15
Witherite:					
Imports for consumption:					
Short tons	4,790	3,066	448	----------	896
Value	$107,238	$60,824	$9,452	----------	$26,736
Barium chemicals:					
Sold by producers:					
Short tons	[5] 75,004	[5] 73,232	[5] 78,323	[5] 73,591	68,070
Value	[5] $6,115,310	[5] $7,630,322	[5] $8,345,422	[5] $7,740,686	$6,817,154
Imports for consumption:					
Short tons	317	385	212	95	35
Value	$15,944	$105,275	$33,120	$7,382	$3,098
Lithopone:					
Sold or used by producers: [6]					
Short tons	176,642	137,320	135,723	142,905	136,161
Value	$12,550,193	$10,828,924	$10,745,305	$11,208,891	$10,645,316
Exports of lithopone:					
Short tons	21,527	17,036	17,320	11,551	11,576
Value	$2,079,229	$1,733,698	$1,637,217	$1,107,430	$1,049,961

[1] F. o. b. mine shipping point.
[2] Declared value f. o. b. foreign market.
[3] Barite sold or used by producers plus imports.
[4] Although all barite is crushed before use in chemicals, barite used in chemicals is not included in the 1945 total. In 1944 and prior years small quantities of crushed barite used by chemical producers are included.
[5] Revised figures; see table "Barium chemicals produced and used or sold by producers in the United States, 1941–45."
[6] Exclusive of cadmium lithopone.

BARITE

CRUDE

PRODUCTION AND CONSUMPTION

For the second successive year, Arkansas produced more barite than any other State, leading Missouri by nearly 38,000 short tons in 1945. The development of a barite industry in Arkansas is quite recent when compared with the pre-Civil War origin of the Missouri industry. Barite was discovered accidentally in Arkansas in drilling a water well on the northern slope of Chamberlin Creek Valley, 15 miles east of Hot Spring, in 1900, but no commercial use was made of it at the time, owing to its impure state and the distance from usual markets. About 100 acres of this area are underlain with barite; and reserves, as yet incompletely mapped, are estimated conservatively at several million tons. The barite bed occurs as a replacement of Stanley shale of Mississippian age, and the width of the minable zone varies from 30 to 70 feet. Little exploratory work was done until about 1930, when interest in the use of barite in drilling oil wells in the Gulf area was becoming widespread. Commercial development still had to await a feasible means of purifying the barite, which contained about 70 percent barium sulfate, the remainder consisting mostly of quartz, shale, and iron oxide. Research by the Bureau of Mines in the 1930's proved that 98 percent pure barite could be obtained from the crude material with a 90-percent recovery using pine oil flotation. Much the same principle is used by the two producers in the area today, except that one floats the barite and the other depresses it.

Sustained production was begun in 1941 by the Magnet Cove Barium Corp., followed in 1942 by the Baroid Sales Division of the National Lead Co. The present workings of the two firms are on opposite converging wings of the same bedded synclinal deposit.

More barite has been taken from Missouri than from any other State, production having been continuous since the 1850's. Although none of the plants is as large as either of the flotation mills in Arkansas, the aggregate of 24 washers suffices to place Missouri just a little below Arkansas as second greatest producer in 1945. Nearly all the washer capacity in Missouri is centered in Washington County, and the average washer produces 1,000 tons a month. The two new washers of the Baroid Sales Division, National Lead Co., in Washington County have about double this capacity.

The new 30-foot double-log washer of the De Soto Mining Co. operated by J. Marshall Thompson in Washington County was described by Shaffer.[3] The new features in this washer, which may become general throughout the county, are detachable Nihard teeth tips on the logs and a revolving grizzly which hastens breaking up of the barite-bearing clay and prevents clogging.

Barite occurs in Missouri, Georgia, and Tennessee in residual clay from weathered dolomite. In Missouri there is very little overburden to be scraped off in order to reach the barite-bearing clay, but in Tennessee and Georgia sometimes 50 to 60 feet of overburden must be removed. Owing to increasing overburden, accompanied by growing mining costs, several producers shifted equipment from Georgia and Tennessee to Missouri in 1945, accounting in part for the increase in Missouri production and the slump in Tennessee

[3] Shaffer, L. S., Barite Mining: Excavating Eng., vol. 40, No. 4, April 1946, pp. 182–185, 219–220.

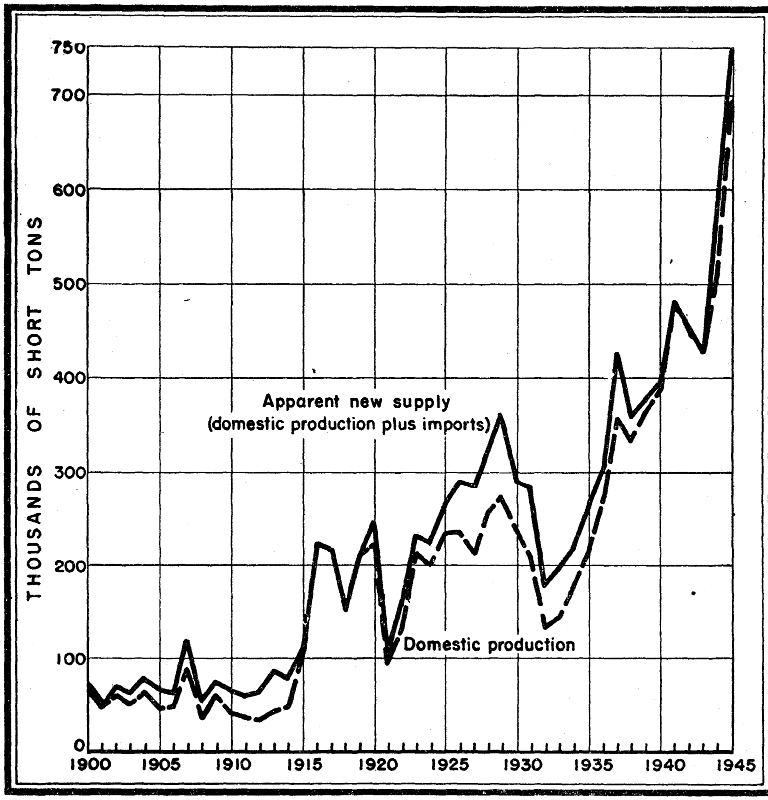

FIGURE 1.—Apparent new supply of barite in the United States, 1900–1945.

output. Among the new producers in Missouri in 1945 were Barytes Mining Co., Potosi, and Missouri Barite Co., Lynn Creek. A new crusher to prepare barite for use in glass was put in operation by Acme Barite Co., Mineral Point, Mo.

The abandonment proceedings initiated by the bondholders of the Yosemite Valley Railroad in 1944 were approved in 1945 by the Interstate Commerce Commission. This railroad carried ground barite for the National Lead Co. from its mill at El Portal, Calif., to Merced, Calif., where the line connected with the Southern Pacific Railway. During the latter part of the year the National Lead Co. instituted a trucking system by building a roadway over part of the former rail bed, crossing the Merced River by bridge a short distance from the mill and continuing to Merced via the All-Year Highway. Shipments, of course, ceased during the conversion of transportation but were resumed in early 1946.

Western producers were active in seeking new deposits. California-Nevada Barytes Mines Division of the Glidden Co. reopened a mine at Tonopah, Nev. Barium Products, Ltd., started production at a mine near Greenville, Plumas County, Calif. Baroid Sales Division of the National Lead Co. acquired the barite property of Industrial Minerals & Chemical Co. at Washington, Calif., and opened a new mine at Auburn, Placer County.

Crude (primary) barite sold or used by producers in the United States, 1944–45, by States

State	1944		1945	
	Short tons	Value	Short tons	Value
Arkansas	159,686	[1] $1,045,546	260,660	[1] $1,934,098
Georgia	108,851	929,090	110,393	1,056,035
Missouri	150,748	1,121,678	225,467	1,841,959
Nevada	22,390	84,859	28,919	106,052
Tennessee	43,033	279,567	32,812	256,756
Other States [2]	33,909	97,749	37,811	153,752
	518,617	3,558,489	696,062	5,348,652

[1] Partly estimated.
[2] 1944: California, North Carolina, and South Carolina; 1945: California and North Carolina.

Principal producers of crude (primary) barite in the United States in 1945

Name and address	Mine or mill location (nearest town)	Method of recovery
ARKANSAS		
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12, Calif.	Malvern	Flotation.
Magnet Cove Barium Corp., Malvern	do	Do.
CALIFORNIA		
Barium Products, Ltd., Newark	Greenville	Shot from veins.
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles.	El Portal	Do.
Industrial Minerals & Chemical Co., 6th and Gilman Sts., Berkeley.	Washington	Do.
GEORGIA		
Barytes Mining Co., Box 224, Cartersville	Cartersville	Washer.
T. E. Johnsey, Cartersville	do	Do.
New Riverside Ochre Co., Cartersville	do	Do.
Paga Mining Co., Cartersville	do	Do.
Railroad Mining Co., Cartersville	do	Do.
George E. Shropshire, Cartersville	do	Do.
MISSOURI		
Baroid Sales Division, National Lead Co., 830 Ducommun St., Los Angeles 12, Calif.	Potosi	Do.
Do	Richwoods	Do.
Cadet Mining Co., Cadet	Mineral Point	Do.
Campbell Bros., Russellville	Cole Camp	Do.
J. E. Carter Mining Co., Potosi	Potosi	Do.
Cordia Mining Co., Potosi	Mineral Point	Do.
De Soto Mining Co., De Soto	Richwoods	Do.
H. & P. Mining Co., Potosi	Old Mines	Do.
Hafner and Thorn Mining Co., Potosi	Potosi	Do.
Fred Hornsey & Co., Potosi	do	Do.
R. M. McBride, Potosi	do	Do.
Midwest Mining Co., Box 87, Potosi	Richwoods	Do.
Ozark Barium Co., Cadet	Blackwell	Do.
Potosi Mining Co., Potosi	Potosi	Do.
Lloyd Sestak, Henley	Henley	Do.
Star Mining Co., Potosi	Old Mines	Do.
Superior Mineral Co., Cadet	Cadet	Do.
Do	Richwoods	Do.
Whaley & Scott Mining Co., Potosi	Potosi	Do.
L. A. Wood, Sweetwater, Tenn	do	Do.
Xact Clays, Inc., Tiff	do	Do.
NEVADA		
Barium Products, Ltd., Newark, Calif	Battle Mountain	Shot from veins.
California-Nevada Barytes Mines Division of the Glidden Co., 766 50th Ave., Oakland, Calif.	Argenta	Do.
Do	Tonopah	Do.
TENNESSEE		
Clinchfield Sand & Feldspar Corp., 618 Mercantile Trust Bldg., Baltimore 2, Md.	Del Rio	Do.
Sweetwater Mining Co., Sweetwater	Sweetwater	Washer.
B. C. Wood, Sweetwater	do	Do.
L. A. Wood, Sweetwater	do	Do.
R. E. Wood, Sweetwater	do	Do.

Crude barite (domestic and imported) used in the manufacture of ground barite and barium chemicals in the United States, 1941–45, in short tons

Year	In manufacture of—			Total	Year	In manufacture of—			Total
	Ground barite [1]	Lithopone	Barium chemicals			Ground barite [1]	Lithopone	Barium chemicals	
1941	243,846	153,982	93,005	490,833	1944	360,045	134,597	100,921	595,563
1942	200,443	144,821	104,160	449,424	1945	482,442	139,288	99,173	720,903
1943	225,154	129,493	99,097	453,744					

[1] Includes some crushed barite.

PRICES

Crude barite in Missouri was sold under a price ceiling established in July 1944 of $8.50 a short ton. Georgia and Tennessee producers have individual ceilings ranging up to $11.50 a long ton. Crude barite in California and Nevada is either used by the producer or sold by contract, and the prices are not available for publication in either case. New ceilings for chemical-grade barite announced under Maximum Price Regulation 327 in 1945 were: L–16, June 18, L. A. Wood Co., $11.50 per long ton, f. o. b. Sweetwater, Tenn. (an increase of $1.50 a ton); L–20, September 17, Barytes Mining Co., $11.50 per long ton, f. o. b. Cartersville, Ga.; and L–21, September 17, New Riverside Ochre Co., $11.50 per long ton, f. o. b. Cartersville, Ga.

WORLD PRODUCTION

World production of barite, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Algeria	3,069	(2)	(2)	2,580	2,753	2,988	1,340	(2)
Argentina	--------	768	2,680	4,174	7,083	(2)	(2)	(2)
Australia	3,231	4,216	5,047	4,990	6,512	4,610	4,487	(2)
Brazil	600	(2)	(2)	(2)	240	(2)	300	(2)
Canada	--------	(2)	307	6,250	17,842	22,202	107,700	127,185
Cuba	--------	12,000	16,105	13,223	[3] 3,787	[3] 3,158	[3] 4,787	[3] 2,093
Egypt	20	31	61	30	60	76	59	(2)
Eire	(2)	(2)	(2)	(2)	(2)	5,485	10,519	(2)
France	(2)	(2)	2,246	4,494	9,563	5,589	2,513	(2)
Germany:								
Austria	373	1,487	839	(2)	(2)	(2)	(2)	(2)
Baden	36,305	35,407	29,119	40,895	44,156	(2)	(2)	(2)
Bavaria	26,748	31,942	47,405	25,792	27,537	29,267	23,023	(2)
Prussia [4]	401,906	337,428	251,070	267,300	258,602	260,000	255,000	(2)
Saxony	230	255	67	15	25	(2)	(2)	(2)
Thuringia	15,315	13,808	13,361	10,699	9,357	(2)	(2)	(2)
Greece	34,700	24,055	(2)	(2)	(2)	(2)	(2)	(2)
India, British	8,205	9,404	19,079	23,844	11,462	9,002	(2)	(2)
Indochina	50	155	185	(2)	(2)	(2)	(2)	(2)
Italy	48,169	53,893	31,870	26,032	37,601	(2)	(2)	(2)
Korea (Chosen)	13,395	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Peru	(2)	(2)	(2)	(2)	(2)	--------	2,352	[5] 3,000
Portugal	24	25	20	46	(2)	1	(2)	(2)
Southern Rhodesia	91	50	(2)	(2)	(2)	(2)	(2)	(2)
Spain	500	8,856	9,936	8,125	7,801	6,309	7,491	(2)
Switzerland	--------	--------	--------	--------	256	268	233	--------
Tunisia	(2)	(2)	(2)	(2)	(2)	72	76	(2)
Union of South Africa	491	439	691	1,390	745	2,740	3,201	[6] 1,443
United Kingdom	77,543	[7] 96,333	[7] 126,331	[7] 103,167	[7] 100,312	[7] 102,736	[7] 100,422	(2)
United States	304,298	331,910	354,219	438,523	408,116	389,451	467,321	628,068

[1] In addition to the countries listed, barite is produced in China, Czechoslovakia, Japan, Mexico, Norway, and U. S. S. R., but data on production are not available.
[2] Data not available.
[3] Exports.
[4] Official figures which, it is reported, cover only output of mines included under the mining law.
[5] Estimate.
[6] January to September, inclusive.
[7] Includes witherite.

Germany.—The Office of Military Government for Germany has released data on German output of barite since 1938. Following the pattern of World War I, production dropped sharply owing to the disappearance of the usual export markets and leveled off to a constant figure reflecting domestic requirements. Figures are given in the accompanying world production table. Barite occurs in bedded deposits at Meggen in Westphalia and in veins in Hessen, Thuringia, Bavaria, Baden, and Silesia. The Meggen deposits are the most productive, yielding on the average from 60 to 75 percent of the total German output. The remainder comes from a large number of small mines. The Meggen properties normally employ about 750 workmen.

Between the two late wars Germany exported substantial quantities of barite to the United States, mostly from Meggen. It was shipped the short distance to the Rhine via canal, loaded on barges there, and towed to Rotterdam. Occasionally in the United States import statistics barite has been reported imported from Netherlands, but as there is no known production in that country it is assumed that the barite is of German origin.

Barite consumers in the Baltimore-to-New York coast area are naturally interested in resumption of purchases of Meggen barite, owing to scarcity of the commodity in the Eastern States, but considerable time is expected to elapse before shipments are received in quantity. After World War I, although transport facilities were virtually intact, no sizable lots were brought over until 1920.

Canada.—The decline in Tennessee production has resulted in profitable importation of barite from Nova Scotia. Canadian Industrial Minerals, a subsidiary of Springer Sturgeon Gold Mines, again increased its production in 1945 and appeared to have excellent prospects for 1946. At a meeting of shareholders it was revealed that the firm had a contract for 26,000 tons with an American consumer and that negotiations were under way with other American firms. Shipments were made to England, Belgium, and the West Indies in early 1946. The barite subsidiary started with a capital of $90,000, and the plant alone is now said to be worth over a million dollars.[4] The mine is said to have produced 106,000 short tons in 1944.[5]

Mexico.—A new source of barite was developed during the closing months of the war, and a few thousand tons were shipped to a lithopone maker in the midwest United States. The barite is mined near La Rosita, Coahuila.

GROUND (AND CRUSHED)

SALES

Oil-well drilling took 86 percent of the ground barite produced in 1945. This outlet has grown tremendously since the 1920's, when a few thousand tons annually were used in "problem" wells of abnormal pressures. The smaller uses of ground and crushed barite, including glass, paint, and rubber, showed little change from 1944.

[4] The Northern Miner, Barite Subsidiary Grows Steadily: Vol. 32, No. 6, May 2, 1946, p. 567 (15).
[5] Currie, D. L., The Mineral Industry of Nova Scotia: Canadian Min. Jour., vol. 67, No. 2, February 1946, p. 112.

Ground (and crushed) barite produced and sold by producers in the United States, 1943–45 [1]

Year	Plants	Production (short tons)	Sales	
			Short tons	Value
1943	18	215,464	208,252	$3,743,919
1944	19	344,377	344,757	5,455,835
1945	20	473,749	468,939	7,519,759

[1] Although all barite is crushed before use in chemicals, barite used in chemicals is not included in the 1945 total. In 1944 and prior years small quantities of crushed barite used by chemical producers are included.

Much of the ground barite reported for use in paint and rubber is bleached; it is also used as a white filler in wall paper, printing ink, and plastics. Unbleached, or "off-colored" ground barite, is used in linoleum, phonograph records, dark paints, and other products where color is immaterial.

Ground (and crushed) barite sold by producers, 1943–45, by consuming industries [1]

Industry	1943		1944		1945	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Well drilling	144,452	69	277,792	80	407,871	87
Paint	15,000	7	23,000	7	21,000	4
Glass	25,464	12	24,153	7	25,761	6
Rubber	8,000	4	10,000	3	10,000	2
Undistributed	15,336	8	9,812	3	4,307	1
	208,252	100	344,757	100	468,939	100

[1] Although all barite is crushed before use in chemicals, barite used in chemicals is not included in the 1945 total. In 1944 and prior years small quantities of crushed barite used by chemical producers are included.

In the foregoing table figures for consumption of ground barite in "Paint," "Rubber," and "Undistributed" have been estimated partly by the grinders and partly by the Bureau of Mines.

PRICES

The average price per short ton of ground and crushed barite in 1945 was $16.04, a slight increase over 1944. Several new ceiling prices on glass-grade barite were published by the Office of Price Administration under Maximum Price Regulation 327 in 1945, as follows: L–1, January 30, Wolf River Corp., $13 per short ton, f. o. b. Jamestown, Tenn.; L–6, March 15, L. A. Wood, $13.50 per short ton, f. o. b. Sweetwater, Tenn. (an increase of $1.00); L–13, May 10, Acme Barite Co., $16.50 per short ton, f. o. b. Mineral Point, Mo.; L–21, September 17, New Riverside Ochre Co., $13 per short ton, f. o. b. Cartersville, Ga. (an increase of $1.50); and L–39, May 8, 1946, J. R. Dellinger, $15.50 per short ton, f. o. b. Tiff, Mo. All the above prices are for bulk material; $2 per ton additional is permitted when packed in multi-ply paper bags.

According to the Oil, Paint, and Drug Reporter, ground bleached barite was quoted at $27.65 a short ton in bags, carlots, St. Louis, Mo., an increase of $2.30 over the 1944 price.

WITHERITE

The shipping shortage of 1944 eased sufficiently in 1945 to permit importation of a little witherite from Great Britain, the world's source. The Baroid Sales Division of the National Lead Co. mined a mixed witherite-barite near El Portal, Calif., and ground the material without separation for oil-well drilling muds. The production of this mixture is reported as barite.

Witherite, crude, unground, imported for consumption in the United States, 1941–45

[Value at point of shipment]

Year	Short tons	Value	Year	Short tons	Value
1941	4,790	$107,238	1944		
1942	3,066	60,824	1945	896	$26,736
1943	448	9,452			

According to the Oil, Paint, and Drug Reporter, witherite, 99 percent through 200-mesh, bags, carlots, works, was nominally quoted at $43 a short ton in 1945.

BARIUM CHEMICALS

PRODUCTION

Output of several of the barium chemicals declined further in 1945 from the peaks attained in 1943, notably the chloride, hydroxide, and nitrate. On the other hand, reconversion of brick kilns accounted for record production of barium carbonate for use as a brick descummer. Production of oxide, peroxide, and sulfate was also up. As all barium chemicals, with the possible exception of the nitrate, have well-recognized peacetime uses, business should be brisk as soon as the Nation recovers from the war.

Barium chemicals produced and used or sold by producers in the United States, 1941–45, in short tons

Chemical	Plants	Produced	Used by producers in other barium chemicals [1]	Sold by producers [2]	
				Short tons	Value
Black ash: [3]					
1941	16	161,723	159,397	1,648	$65,350
1942	18	163,119	163,043	950	41,275
1943	18	148,179	147,975	553	23,969
1944	17	153,624	153,573	371	16,316
1945	15	149,871	149,203	257	10,490
Carbonate (synthetic):					
1941	5	21,857	5,297	16,298	724,977
1942	7	30,204	14,724	14,905	830,034
1943	5	35,308	21,513	13,979	753,832
1944	5	37,911	27,551	9,313	467,288
1945	5	40,689	25,139	15,287	905,402
Chloride (100 percent basis):					
1941	3	13,873	994	12,789	1,038,322
1942	3	13,439	1,722	11,497	913,290
1943	3	15,379	5,111	10,545	942,399
1944	3	17,183	5,766	11,446	955,571
1945	3	14,766	4,743	9,562	831,072
Hydroxide:					
1941 [4]	5	2,524	438	1,502	173,263
1942	[4] 4	[4] 3,368	66	[4] 3,202	[4] 366,472
1943	4	[4] 3,444	54	[4] 3,398	[4] 337,107

See footnotes at end of table.

Barium chemicals produced and used or sold by producers in the United States, 1941–45, in short tons—Continued

Chemical	Plants	Produced	Used by producers in other barium chemicals[1]	Sold by producers[2]	
				Short tons	Value
Hydroxide—Continued					
1944	3	2,462	98	2,429	$244,072
1945	3	2,334	123	2,135	242,124
Nitrate:					
1941	3	491		432	72,539
1942	5	11,547		11,489	2,262,061
1943	5	12,157		12,324	2,376,631
1944	3	11,160		11,333	2,066,976
1945	2	(5)		(5)	(5)
Oxide:					
1941	2	(5)	(5)	(5)	(5)
1942	3	3,922	3,543	155	30,752
1943	3	5,189	4,998	170	37,925
1944	3	4,748	4,638	84	19,158
1945	3	6,253	5,965	260	52,057
Peroxide:					
1941	2	(5)	(5)	(5)	(5)
1942[4]	3	3,054	1,803	1,223	289,187
1943	3	4,123	1,682	2,495	563,756
1944	2	(5)	(5)	(5)	(5)
1945	2	(5)	(5)	(5)	(5)
Sulfate (synthetic):					
1941	7	[4] 30,543	[4] 20,432	11,302	668,084
1942	6	[4] 25,779	[4] 17,194	[4] 8,324	[4] 512,969
1943	7	[4] 24,606	[4] 13,087	[4] 12,028	[4] 752,089
1944	8	[4] 30,804	[4] 18,720	[4] 11,340	[4] 790,366
1945	8	30,822	17,602	12,856	922,902
Other barium chemicals:[6]					
1941	(7)	[4] 33,641	4,782	[4] 31,033	[4] 3,372,775
1942[4]	(7)	24,539		21,487	2,384,282
1943[4]	(7)	22,831		22,831	2,557,714
1944	(7)	[4] 30,111	2,904	[4] 27,275	[4] 3,180,939
1945	(7)	36,412	4,405	27,713	3,853,107
Total:					
1941	[8] 20			[4] 75,004	[4] 6,115,310
1942	[8] 23			[4] 73,232	[4] 7,630,322
1943	[8] 24			[4] 78,323	[4] 8,345,422
1944	[8] 22			[4] 73,591	[4] 7,740,686
1945	[8] 19			68,070	6,817,154

[1] Includes purchased material.
[2] Exclusive of purchased material and exclusive of sales by one producer to another.
[3] Black-ash data include lithopone plants.
[4] Revised figures.
[5] Included under "Other barium chemicals."
[6] 1941–45: Consists mostly of titanium dioxide-barium sulfate pigments, with small quantities of barium acetate, chromate, nitrate, oxide, perchlorate, and peroxide. Specific chemicals may not be revealed by specific years.
[7] Plants included in above figures.
[8] A plant producing more than 1 product is counted but once in arriving at grand totals.

Lithopone [1] sold or used by producers in the United States, 1941–45

	1941	1942	1943	1944	1945
Plants	9	9	9	8	8
Short tons	176,642	137,320	135,723	142,905	136,161
Value	$12,550,193	$10,828,924	$10,745,305	$11,208,891	$10,645,316

[1] Exclusive of cadmium lithopone.

CONSUMPTION

In its 1945 canvass of barium chemicals, the Bureau of Mines, at the request of some of the producers, for the first time asked for end uses of certain barium chemicals. Precise figures were not available in some cases, as not all of the respondents maintained records of end uses of their chemicals sold. The following table is therefore only an approximation, consisting partly of precise figures and partly of estimates. One chemical on the questionnaire, barium peroxide, is not shown because there were only two producers; and another item, barium hydroxide, is not shown because of the uncertainty of the percentages of its end use distribution (mostly lubricants). Each of the figures represents sales of at least three firms, in order to avoid disclosure of individual operations.

Estimated distribution of consumption of specified barium chemicals in the United States in 1945, in short tons

[Exclusive of consumption in making other barium chemicals]

Consuming industry	Precipitated barium carbonate	Barium chloride, basis 100% $BaCl_2$	Precipitated barium sulfate (blanc fixe)
Brick descumming	5,200		
Ceramics, glazes, enamels, and glass	3,400		(1)
Linoleum and oilcloth			[2] 700
Oil well drilling	4,000		
Paint and printing ink		1,700	[3] 22,100
Paper, plastics, and rubber		[2] 3,800	5,600
Steel carburizing	1,600	700	
Other	[4] 1,100	[5] 3,300	[6] 2,100
	15,300	9,500	30,500

[1] Included under "Other."
[2] Includes textiles.
[3] Includes that used in titanium dioxide-barium sulfate pigments.
[4] Unspecified.
[5] Includes reagent use, food products, petroleum products, soap, cleansers, and unspecified uses.
[6] Includes medicinal and ceramic uses and exports.

Lithopone [1] sold or used by producers, 1943–45, by consuming industries

Industry	1943		1944		1945	
	Short tons	Percent of total	Short tons	Percent of total	Short tons	Percent of total
Paints, enamels, and lacquers	103,860	76	108,800	76	109,398	80
Floor coverings and textiles	15,999	12	14,746	10	15,821	12
Rubber	1,078	1	726	1	977	1
Other	14,786	11	18,633	13	9,965	7
	135,723	100	142,905	100	136,161	100

[1] Exclusive of cadmium lithopone.

PRICES

Range of quotations on barium chemicals, 1943–45 [1]

	1943	1944	1945
Lithopone:			
Ordinary, bags, at New York .... pound	\$0.04¼–\$0.04¾	\$0.04¼–\$0.04¾	\$0.04¼–\$0.04¾
Ordinary, barrels, at New York .... do	.04½	.04½	.04½
Titanated, bags .... do	.056	.056	.056
Titanated, barrels .... do	.0585	.0585	.0585
Barium carbonate, precipitated, 200-pound bags, carlots, works .... short ton	55.00 –60.00	55.00 –70.00	60.00 –70.00
Barium chlorate, 112-pound kegs, works .... pound	.36	.36	.27½– .31
Barium chloride, technical, crystals, barrels, carlots, works .... short ton	79.00 –92.00	75.00 –90.00	73.00
Barium peroxide, drums, carlots, works .... pound	.10 – .13	.10 – .13	.10 – .13
Barium hydrate, 500-pound barrels, works .... do	.06 – .07	.06 – .07	.06 – .07
Barium nitrate, barrels, carlots, works .... do	.11 – .12	.10 – .12	.09½– .11½
Blanc fixe (dry):			
Direct process, bags, carlots, works .... short ton	70.00	70.00	70.00
Byproduct, bags, carlots, works .... do	60.00	60.00	60.00

[1] Oil, Paint, and Drug Reporter.

FOREIGN TRADE

Barium chemicals imported for consumption in the United States, 1941–45

[Value at port of shipment]

Year	Lithopone		Barium dioxide		Blanc fixe (precipitated barium sulfate)		Barium chloride	
	Short tons	Value	Pounds	Value	Short tons	Value	Short tons	Value
1941	(1)	$9	4,032	$208	15	$865		
1942			40,992	2,119	28	1,357	36	$15,770
1943							18	7,885
1944								
1945	(2)	7						

Year	Barium nitrate		Barium hydroxide		Barium compounds (n. e. s.)	
	Short tons	Value	Short tons	Value	Short tons	Value
1941			292	$10,791	8	$4,071
1942	(3)	$1	147	9,361	154	76,667
1943			151	9,850	43	15,385
1944			95	7,382		
1945			35	3,091		

[1] 112 pounds. [2] 75 pounds. [3] 53 pounds.

Lithopone exported from the United States, 1941–45

Year	Short tons	Value		Year	Short tons	Value	
		Total	Average			Total	Average
1941	21,527	$2,079,229	$96.59	1944	11,551	$1,107,430	$95.87
1942	17,036	1,733,698	101.77	1945	11,576	1,049,961	90.70
1943	17,320	1,637,217	94.53				

POTASH

By Bertrand L. Johnson and Dorothy I. Marsh

SUMMARY OUTLINE

GENERAL CONDITIONS

More new records were made in 1945 in the potash industry of the United States, new highs being reached both in the production of marketable potassium salts and in sales. In 1945, 1,588,305 short tons of potassium salts containing 874,243 tons of equivalent potash were produced. (See fig. 1.) A slightly larger quantity (1,597,160 tons), also a record, was sold; this material contained 870,370 tons of equivalent potash, according to the producers. Stocks of potassium

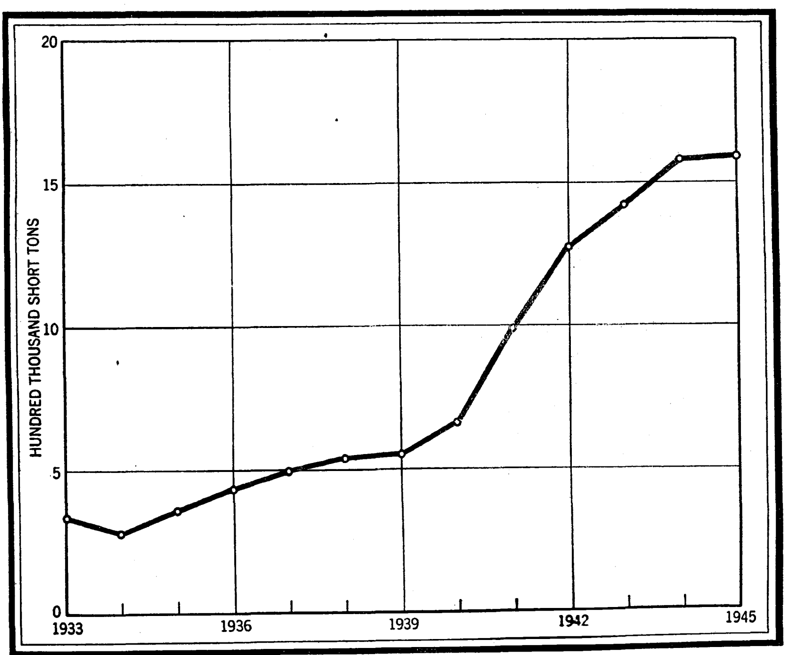

FIGURE 1.—Production of marketable potash salts in the United States, 1933–45.

salts in producers' hands at the end of 1945 were a little less than in 1944 but in terms of contained K_2O are reported to have been larger than in any recent year. Exports of fertilizer potash materials were less in 1945 than in 1944, but those for chemical uses were somewhat larger. Imports of potash materials for fertilizer purposes in 1945 were about half those in 1944, whereas those for chemical use were about double the imports for that use in 1944. Domestic consumption of potash again made a new high record—this time exceeding 800,000 short tons.

The economics of the domestic potash industry were discussed by Backman,[1] in a paper prepared for the American Potash Institute and published by that organization early in 1946, and by Turrentine,[2] in a paper in Better Crops with Plant Food, a journal published by the American Potash Institute.

Salient statistics of the potash industry in the United States, 1943–45

	1943	1944	1945
Production:			
Potassium salts (marketable) short tons	1,428,840	1,578,498	1,588,305
Approximate equivalent, K_2O do	739,141	834,568	874,243
Sales by producers:			
Potassium salts do	1,401,271	1,543,420	1,597,160
Approximate equivalent, K_2O do	732,151	817,892	870,370
Value at plant	$26,183,073	$29,487,413	$30,313,919
Average per ton	$18.69	$19.11	$18.98
Imports:			
Fertilizer materials short tons	45,009	13,739	6,885
Approximate equivalent, K_2O do	17,005	3,760	3,870
Value	$1,287,022	$397,575	$230,714
Chemical materials short tons	419	5,402	10,327
Approximate equivalent, K_2O do	104	1,108	2,152
Value	$156,097	$1,650,776	$3,079,761
Exports:			
Fertilizer materials short tons	111,541	110,057	104,687
Approximate equivalent, K_2O [1] do	60,142	61,312	58,310
Value	$3,168,446	$3,139,631	$2,986,990
Chemical materials short tons	20,133	15,444	18,966
Approximate equivalent, K_2O [1] do	9,865	7,568	9,273
Value	$3,950,542	$3,142,096	$3,648,795
Consumption:			
Apparent consumption: [2]			
Potassium salts short tons	1,315,025	1,437,060	1,490,719
Approximate equivalent, K_2O do	679,253	753,880	808,809
Actual sales for consumption:			
Approximate equivalent, K_2O do	678,131	752,319	807,038

[1] Estimate by Bureau of Mines.
[2] Quantity sold by producers, plus imports, minus exports.

Potash Allocation Order M–291 was amended April 3, 1944, and extended another 12 months. Effective March 22, 1945, however, all primary potash salts (muriate of potash, sulfate of potash, and sulfate of potash-magnesia) were removed from Allocation Order M–291 and placed in Schedule 98 under General Chemical Order M–300. This schedule was later revoked, effective September 30, 1945, and the above-mentioned potassium salts removed from allocation, but contract commitments for delivery made during the allocation period extended through March 31, 1946, delaying establishment of the order until after that date. Early in March, however, the Potash Producers Industry Advisory Committee recommended to the Civilian Produc-

[1] Backman, Jules, The Economics of the Potash Industry: Am. Potash Inst., Inc., Washington, D. C., 1946, 55 pp.
[2] Turrentine, J. W., Potash—in War and Peace: Better Crops with Plant Food, vol. 29, No. 9, November 1945, pp. 17–23, 42–45.

tion Administration that primary potash salts be put back under allocation until present excessive demands are reduced to more normal levels.

OUTLOOK

World demand for potash appears to exceed supply, and it is expected that domestic production will be forced to continue for some time at a high rate to meet an enlarged food-production program and foreign commitments. Present domestic potash mines can produce much more than normal peacetime requirements; this surplus must, if maintained, inevitably compete with the large European and Near East supplies when the needs of the famine-stricken portions of the world have been met. The eventual availability of large foreign supplies will limit American participation in foreign markets and certain of these foreign potash-producing nations may enter the domestic market, especially if it is considered advisable in a long-range perspective to restrict domestic production to conserve our known potash reserves.

Early in 1946 a comprehensive study by Turrentine of past consumption and future requirements of potash salts in American agriculture was released by the American Potash Institute.[3]

DOMESTIC RESERVES

The world potash industry is based primarily upon immense natural deposits of potassium chloride, principally in Germany and Russia. Any study of domestic reserves of this intensely competitive commodity, especially with the free importation of potash fertilizers into the United States, must consider that fact. The development of a domestic industry based upon the higher unit-cost sulfate salts in competition with German and Russian chlorides would be difficult.

The domestic deposits of potassium chloride, of present known commercial workability, from which potash can be recovered profitably at the current level of prices are limited to four isolated sylvite deposits near Carlsbad, N. Mex., and to the natural brines of Searles Lake, Calif., and Salduro Marsh, Utah. Reserves of potassium sulfates of proved economic importance are limited to a langbeinite bed in the Carlsbad region, N. Mex. Most of the proved economically important potash deposits in the United States are in New Mexico. Compared with these, the potash reserves in the workable brines of California and Utah are much less important.

A study of the potash reserves of the United States by Samuel H. Dolbear of Behre Dolbear & Co., consulting mining engineers and geologists, made for the American Potash Institute, the national organization of the domestic potash producers, was released by the latter organization early in 1946.[4] This report estimated the total known net recoverable reserves of potash in the brines and highly soluble salts in the United States at 73,000,000 short tons K_2O. It placed the economically recoverable reserves of New Mexico, in terms

[3] Turrentine, J. W., Past Consumption and Future (1950) Requirements of Potash Salts in American Agriculture: Am. Potash Inst., Inc., Washington, D. C., 1946, 31 pp.

[4] Dolbear, Samuel H., of Behre Dolbear & Co., Potash Reserves of the United States: Behre Dolbear & Co., New York-Los Angeles. 20 pp.; copyright, 1946, by American Potash Institute, Inc., Washington, D. C.

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of merchantable potash salts produced, at only 58,000,000 tons of K_2O in beds containing not less than 14 percent K_2O, in salts of high solubility, and not less than 4 feet in thickness. The actual lower limit of profitably workable beds in terms of grade and thickness is not stated, the lower limits used being those arbitrarily chosen in previous estimates. The above figure includes a considerable quantity of potash in mine pillars, which may or may not be recoverable in future operations. No evidence has been published indicating the existence in the New Mexico field of similar high-grade commercial deposits of either sylvite or langbeinite, and while they might exist and should be sought for, because of the peculiarly isolated spotty occurrence of the known commercial deposits in this field, other deposits would be very hard to locate if they existed. From the published data no estimates of additional reserves in these at present hypothetical deposits appear justifiable.

Potash reserves in the brines of Searles Lake, San Bernardino County, Calif., were originally estimated by Gale and Hicks[5] at 20 million tons of K_2O. The Dolbear report states that "further development has * * * * extended the amount stated in this estimate and potash in solution in the brines is still believed to be not less than 20 million tons after deducting past production," of which 14,000,000 tons is said to be definitely recoverable, assuming 70 percent extraction.

The above estimate may be somewhat high when the reserves in the lake are considered in the light of information given in a recent report of the Alien Property Custodian.[6] Substantially all of the crystalline salt body of Searles Lake is controlled by two companies, the American Potash & Chemical Corp., and the West End Chemical Co. Regarding the holdings of the American Potash & Chemical Corp. the prospectus states:

The Director of the Research and Development Department of the Company estimated that as of July 1, 1945, the recoverable brine reserves in the fee and leased lands contained 8,561,874 tons of equivalent muriate of potash, 60 percent K_2O. Such brine reserves have an average concentration of potassium chloride equivalent to the average concentration pumped into the plant over the past 6 years. On the basis of the Company's experience of an over-all efficiency of 60 percent recovery from the brine in the lake in the past 2 years' operations, he estimated that such brine reserves in the fee and leased lands are sufficient for at least 25 years at the present annual production rate of approximately 200,000 tons of equivalent muriate of potash, 60 percent K_2O. * * * *

In arriving at his estimate, the Director of the Research and Development Department of the Company proceeded on the assumption that the Company would continue to operate the leased and fee lands as a unit for the period stated. If, however, all of the brine requirements of the plant at the present annual rate of consumption were drawn from the fee lands alone, he estimates that the brine reserves contained in the fee lands having an average chemical concentration equal to the average of the grade drawn from the entire property over the past 6 years would be sufficient for at least 2 years' operations.

In making the foregoing estimates the Director of the Research and Development Department did not take into consideration the large quantity of lower-grade brine reserves in the fee lands and in the leased lands, nor did he consider the large tonnage of raw material present as solid salts in the deposits. The Research and Development Department of the Company has under investigation the lower-grade brine reserves and the solid salts. Such investigation has not

[5] Gale, H. S., and Hicks, W. B., Potash in 1917: Geol. Survey Mineral Resources of the United States, 1917, part II: 26, 1919, pp. 397–481.

[6] Alien Property Custodian, Prospectus, 478,194 Shares American Potash & Chemical Corp. Class B Stock: 120 Broadway, New York 5, N. Y., Mar. 11, 1946, 32 pp.

yet reached the point which will permit any conclusion to be drawn as to the extent of such reserves or salts or the possibility of utilization thereof on a commercial basis.

The company's estimate of recoverable brine reserves containing 8,561,874 tons of muriate of potash, 60 percent K_2O, reduces to 5,137,-124 tons of K_2O, of which only 60 percent can be extracted in the plant operations, or 3,082,275 tons of K_2O in merchantable potash salts.

No estimates of the potash reserves in the 2,780-acre lease of the West End Chemical Co. are available, but on a comparable basis they might amount to 2,780,000 tons of equivalent muriate of potash, 60 percent K_2O, possibly capable of yielding approximately 1 million tons of K_2O in merchantable potash salts. The total potash reserves in the brines of Searles Lake recoverable in merchantable potash salts would be about 4 million tons of K_2O.

Regarding the reserves in the Salduro Marsh, Utah, the Dolbear report states that:

The extent of these brines has been partly determined by drilling but there are no published estimates of reserves. Such figures as are available indicate a maximum amount of 1,700,000 tons of K_2O. Recoverable potash may amount to around 1,000,000 tons.

All potash resources in the United States other than those considered above have yet to be proved by actual commercial operations to be recoverable profitably at the current level of prices. These sources include the Grand County, Utah, sylvite deposits, polyhalite, greensands, shales, slates, wyomingite, cement-kiln and blast-furnice dusts, mine tailings, alunite, feldspar, distillery wastes, seawater, and kelp. These "strategic" or "potential" reserves are discussed in considerable detail in the Dolbear report and quantitative estimates given of the K_2O content obtainable from many of them.

PRODUCTION AND SALES

Since 1934 production and sales of domestic marketable potassium salts have increased annually. The increase in 1945 over 1944 was not as large, however, as that shown in the latter year over 1943, either in the salts produced or in the sales. Production of potassium salts in 1945 totaled 1,588,305 short tons, with an equivalent K_2O content of 874,243 tons. Sales were 1,597,160 tons, with an equivalent K_2O content of 870,370 tons. Sales of potassium salts exceeded production, and producers' stocks decreased, but the contained K_2O content of the sales was less than that of the output as reported by the producers, and the K_2O content of the stocks increased and was larger than in recent years. The value of the sales exceeded 30 million dollars. The average value per ton of the potassium salts sold in 1945 was $18.98.

Production of both grades of muriate of potash, as shown in the following table, was larger in 1945 than in 1944. Production of manure salts and of the sulfate of potash and sulfate of potash-magnesia was, however, much less.

Western States production still dominates the potash industry. California, New Mexico, and Utah furnished virtually all of the 1945 output, the larger part coming from the deeply buried Permian saline sedimentary deposits of the Carlsbad region of southeastern New

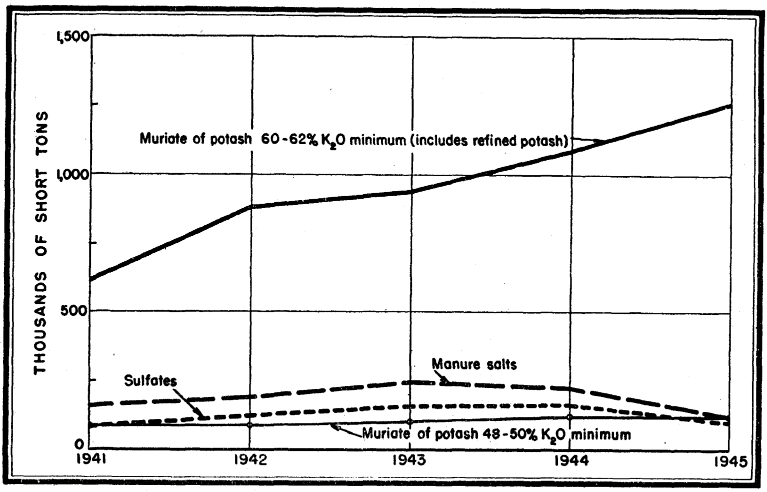

FIGURE 2.—Potassium salts produced in the United States, 1941–45, by grades, in short tons.

Potassium salts produced in the United States, 1943–45, by grades, in short tons

Grade	1943	1944	1945
Muriate of potash:			
60–62 percent K_2O minimum [1]	934, 961	1, 082, 132	1, 258, 332
48–50 percent K_2O minimum	99, 137	114, 550	117, 677
Manure salts, run-of-mine	242, 189	217, 560	115, 798
Sulfate of potash and sulfate of potash-magnesia	152, 553	164, 256	96, 498
	1, 428, 840	1, 578, 498	1, 588, 305

[1] Includes refined potash.

Mexico. The Eastern States supplied only a small quantity—a by-product of cement operations in Maryland.

The potash-producing companies in the United States in 1945, by States, were as follows:

California:

The American Potash & Chemical Corp., 122 East Forty-second St., New York, N. Y. (plant at Trona, on Searles Lake, Calif.).

Maryland:

North American Cement Corp., 41 East Forty-second Street, New York, N. Y. (plant at Security, Md.).

New Mexico:

International Minerals & Chemical Corp., 20 North Wacker Drive, Chicago, Ill. (mine and plant near Carlsbad, N. Mex.).

Potash Company of America, Carlsbad, N. Mex. (mine and plant near Carlsbad, N. Mex.).

United States Potash Co., Inc., 30 Rockefeller Plaza, New York, N. Y. (mine and plant near Carlsbad, N. Mex.).

Utah:

Bonneville, Ltd., 540 West Seventh South, Salt Lake City, Utah (plant near Wendover, Utah).

Kalunite, Inc., 600 West 33d South, Salt Lake City, Utah (mine at Marysvale, Utah).

Potassium salts produced, sold, and in producers' stocks in the United States, 1941–45

Year	Production			Sales				Producers' stocks		
	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)	Value f. o. b. plant	Operators	Potassium salts (short tons)	Equivalent as potash (K_2O) (short tons)
1941	7	986,458	524,875	7	994,843	531,346	$17,368,237	7	26,374	9,712
1942	7	1,267,455	679,206	7	1,277,317	680,831	22,962,518	7	14,158	6,041
1943	7	1,428,840	739,141	7	1,401,271	732,151	26,183,073	7	43,591	13,984
1944	6	1,578,498	834,568	6	1,543,420	817,892	29,487,413	6	76,123	29,763
1945	7	1,588,305	874,243	6	1,597,160	870,370	30,313,919	7	68,796	34,253

CONSUMPTION

Apparent consumption of potash salts in the United States and its possessions increased from 753,880 short tons of potash (K_2O) in 1944 to 808,809 tons in 1945, as determined by subtracting exports from the sum of the imports and producers' sales.

The following table, based largely upon deliveries of potash of domestic origin as reported by the American Potash Institute, indicates actual sales of 807,038 tons for domestic consumption in the United States in 1945, a considerable increase over the 752,319 tons in 1944.

Sales of potash in the United States for consumption and export, 1943–45, in short tons of K_2O

	1943	1944	1945
Deliveries of primary potash of domestic origin by major companies, as from reports of American Potash Institute—			
In United States and possessions:			
Agricultural	590,733	675,787	724,900
Chemical	84,367	82,198	85,169
For export	55,261	57,850	58,117
	730,361	815,835	868,186
Imports for consumption plus sales of minor domestic producers	17,777	5,364	6,435
	748,138	821,199	874,621
Total exports (estimate by Bureau of Mines)	70,007	68,880	67,583
Actual sales for consumption in the United States	678,131	752,319	807,038

Apparent domestic consumption of potassium salts, in terms of equivalent potash (K_2O), and its relationships to sales of domestic producers, as reported to the Bureau of Mines for a period of years, are shown in figure 3.

According to the American Potash Institute, 90 percent of the total deliveries of America's potash in 1945 was to the fertilizer industry and 10 percent for chemicals.

Deliveries of agricultural and chemical potash in 1945 are shown by States of destination in the accompanying tables. Georgia was the leading recipient of agricultural potash in 1945, taking, however, only a little over 9 percent of total deliveries for that purpose. New York took 67 percent of potash deliveries for chemical purposes; no other State took over 6 percent.

Deliveries in 1945 of agricultural potash salts of American origin, by states of destination, in short tons of K_2O

[Data from American Potash Institute]

Georgia	64,816	Kentucky	6,691
Ohio	59,987	Wisconsin	6,420
Florida	57,354	Connecticut	4,703
Virginia	56,813	Texas	4,336
Illinois	55,915	Missouri	3,612
North Carolina	47,672	Delaware	3,112
Maryland	47,542	Minnesota	2,724
South Carolina	42,478	Washington	2,475
Indiana	36,851	Oregon	1,160
New Jersey	28,914	Iowa	828
Alabama	25,636	Vermont	455
Tennessee	21,801	Idaho	264
Pennsylvania	16,183	Colorado	222
Maine	14,479	North Dakota	180
New York	13,982	Rhode Island	142
Louisiana	13,371	West Virginia	96
Michigan	11,717	District of Columbia	83
Massachusetts	11,628	New Hampshire	72
California	11,380	Montana	27
Mississippi	11,132	Utah	20
Arkansas	7,801	New Mexico	26

Deliveries of chemical potash salts of American origin, by States of destination, in 1945, in short tons of K_2O

[Data from American Potash Institute]

New York	56,867	Oregon	592
Pennsylvania	4,627	Minnesota	546
California	4,547	Delaware	490
Texas	2,992	Kansas	291
Ohio	2,786	Connecticut	285
Michigan	2,701	Nevada	229
West Virginia	2,421	Louisiana	108
New Jersey	2,267	Indiana	41
Maryland	1,006	Iowa	36
Illinois	882	Massachusetts	34
Oklahoma	767	Kentucky	31
Missouri	597	North Carolina	26

PRICES

Maximum Price Regulation 404—Potash, effective June 18, 1943, was in effect until July 5, 1944, when it was superseded by Revised Maximum Price Regulation 205 (Fertilizer Raw Materials) of June 30, 1944. Muriate of potash, manure salts, sulfate of potash, and sulfate of potash-magnesia were covered in the new regulations, as in the old. No changes were made in the base ceiling prices in the new regulation and none have since been made.

The following prices were reported by various producing companies for the 1945–46 fertilizer season; most of them are ceiling prices, but that for the muriate of potash, 50 percent K_2O grade, is below ceiling price.

Muriate of potash (62 to 63 percent; 62 percent K_2O minimum)	53½ cents per unit K_2O
Muriate of potash (60 percent K_2O minimum)	
Muriate of potash granular (50 percent K_2O minimum)	
Muriate of potash, granular (48 percent K_2O minimum)	
Manure salts (22 percent K_2O minimum)	20 cents per unit K_2O.
Sulfate of potash (90 to 95 percent K_2SO_4, basis 90 percent K_2SO_4)	\$36.25 per short ton.
Sulfate of potash-magnesia (basis 40 percent K_2SO_4, 18.50 percent MgO)	\$26.00 per short ton.

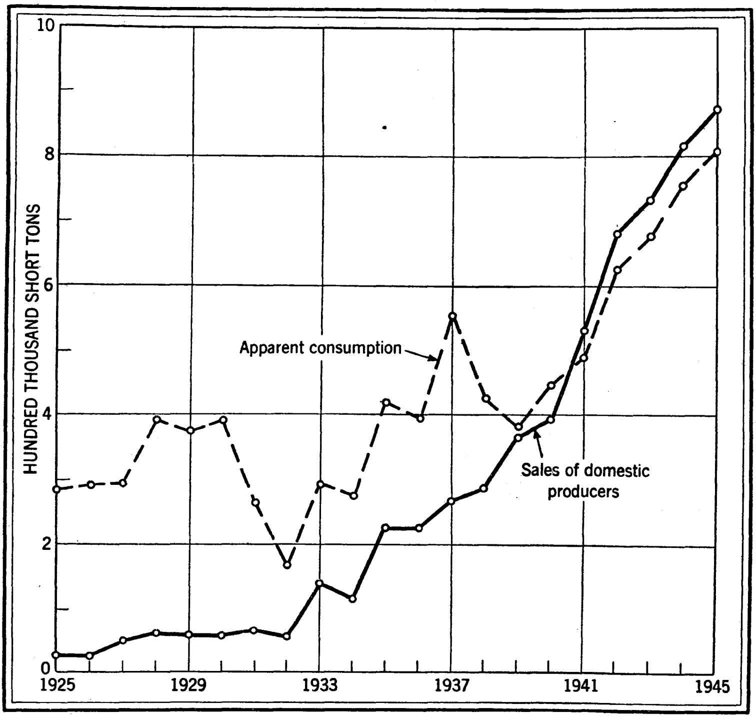

FIGURE 3.—Comparison of apparent domestic consumption of potash (K_2O) and sales by domestic producers of potash in the United States, 1925–45.

Retail prices of potash were covered during 1945 by Second Revised Maximum Price Regulation 135 as amended at diverse times up to and including amendment 4, effective November 26, 1945.

REVIEW BY STATES

General.—Four States—California, Maryland, New Mexico, and Utah—produced merchantable potash salts in 1945. The output of the individual States cannot be given (except for New Mexico, where three companies were operating) without disclosing individual company returns. New Mexico was by far the largest domestic producer, furnishing 85 percent of the total. California, although a much smaller producer than New Mexico, furnished much more than the combined output of the other two States.

A $CaCl_2$-KCl brine from the Gulf Oil Corp. Salina No. 1 well near Bay City, Mich., is reported [7] to be the most highly mineralized brine ever recorded. The total solids contained in the brine amounted to 642,798 milligrams per liter. The potassium (K) content was 21.362 milligrams per liter.

California.—The only potash producer in California, which is also the only one on the entire Pacific Coast, is the American Potash &

[7] Case, L. C., Exceptional Silurian Brine near Bay City, Mich.: Bull. Am. Assoc. Petrol. Geol., vol. 29, No. 5, May 1945, pp. 567–570.

Chemical Corp. (122 East Forty-second Street, New York, N. Y.). This company, recovering potash from the brine saturating the crystalline salt mess of Searles Lake in southeastern California, produces and markets potassium chloride and potassium sulfate. Several descriptions of the company and its operations have been published lately.[8]

The 478,194 shares (90.79 percent of those issued and outstanding) of the stock of the American Potash & Chemical Corp., which had been vested by the Alien Property Custodian by Vesting Order 249 executed at Washington, D. C., on October 20, 1942, as amended, under the authority of the Trading with the Enemy Act, as amended, and Executive Order 9095, as amended, was sold by the Custodian on March 27, 1946, to a group of investment bankers.

On February 12, 1946, the United States instituted an action against the American Potash & Chemical Corp. in the District Court of the United States for the Southern District of California, Central Division, to cancel the company's leases, claiming certain violations of the antitrust laws and misrepresentation to the United States Department of the Interior of the citizenship of the holders of its stock. On the same day the company filed its answer denying the charges and averring that the 90.79 percent of the capital stock of the company had been vested by the Alien Property Custodian, after which, according to the prospectus issued by the Custodian:

> The Court, without any evidence having been adduced and without any findings of fact or conclusions of law, entered a consent judgment which, among other things, imposes certain restrictions upon the issuance and transferability of certain shares of capital stock of the Company (which stock was on February 16, 1946, converted into the Class B. stock of the Company) * * * *. The judgment also enjoins the Company, during the term of the leases and any extension thereof, from disposing of any of its property, or transferring direct or indirect control of any of its property, to any person, corporation, or other business organization to whom issuance of stock is prohibited by the judgment, but excluded from such injunction sales of the Company's products and assets in the normal course of business. * * * * The judgment further provides for forfeiture of the leases upon proof of violation of any of the provisions of the judgment outlined above, or upon election or employment, as an officer or director of the Company, of any person to whom the issuance of stock of the Company is prohibited by the consent judgment. The judgment also directs the execution of an amendment to each of the leases in the form annexed to the judgment which incorporates therein substantially all of the provision of the consent judgment and provides for forfeiture upon proof of violation of any of the provision of the lease as so amended. Each of the leases was amended in accordance with the directions of the judgment.

Maryland.—Only one company in Maryland produced potash in 1945. This was the North American Cement Corp., of New York City, which recovered byproduct potash at its plant at Security, Washington County, near Hagerstown. The product, an impure sulfate of potash from the cement-kiln flue dust, was sold for agricultural use.

This was also the only operation of this kind reported in the United States in 1945.

New Mexico.—Mine production of potash salts in the Carlsbad re-

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[8] Chemical Industries, Lithium from Searles Lake: Vol. 56, No. 3, March 1945, p. 405. (One page with airplane view of the plant. Brief description of deposit.)
Bradley, W. W., Flow Sheet of American Potash & Chemical Corp. at Searles Lake, Calif.: California Jour. Mines and Geol., vol. 41, No. 4, October 1945, pp. 361–363.
Chemical and Metallurgical Engineering, Searles Lake Chemicals: Vol. 51, No. 10, October 1945, pp. 134–137. (1 page of text and flow sheet of plant.)
Alien Property Custodian, Prospectus, 478,194 Shares American Potash & Chemical Corp. Class B Stock: 120 Broadway, New York 5, N. Y., Mar. 11, 1946, 32 pp.

gion of New Mexico continued to increase in 1945, and again a new record was made. The three companies operating in this area mined 3,949,983 short tons of sylvinite and crude langbeinite combined—an increase of 200,733 tons over 1944 but a smaller increase than was made in 1944 over 1943. The K_2O content of the mine production in 1945 was 842,930 short tons. The average equivalent K_2O content of the mined salts increased but slightly, only from 21.33 percent in 1944 to 21.34 percent in 1945.

All three companies mined sylvite (potassium chloride) and one—the International Minerals & Chemical Corp.—also mined langbeinite (a potassium-magnesium sulfate). The greater part of the mine production was sylvite, most of which was processed to yield 60 percent or higher-grade K_2O muriate. The production of merchantable potash salts in New Mexico in 1945 was 1,354,187 short tons, with an equivalent K_2O content of 738,782 tons. Sales were 1,360,189 tons, with an equivalent K_2O content of 733,176 tons, valued at $25,456,731. Muriate of potash was produced by all three companies. Potassium sulfate and potassium-magnesium sulfate (sulfate of potash-magnesia) were produced from crude langbeinite by the International Minerals & Chemical Corp. in the refinery at its mine near Carlsbad. Potassium sulfate was also produced by the Potash Company of America.

Developments in 1945 in the New Mexico[9] potash mines were described by Barr.

Utah.—Commercial production of potash in Utah in 1945 was restricted to the potassium-bearing brines of Salduro Marsh and to the alunite deposits of the Marysvale district.

Bonneville, Ltd., continued to produce potassium chloride from these brines at its plant near Wendover, Tooele County, northwestern Utah. A description of the operations of this company was published during the year.[10]

Alunite-mining operations were carried on in the Marysvale district, Piute County, by Kalunite, Inc. (600 West 33d South, Salt Lake City, 8, Utah), at the White Horse mine at Marysvale. A small tonnage of alunite was mined in open-cut operation. Several thousand tons of crude alunite, largely from mine stocks, were shipped to its Salt Lake City alumina plant, where it was milled, with a considerable tonnage from the stocks at that place. The Salt Lake City plant was operated only on an experimental basis, most of the potash from the ore milled being used in building up to cyclic circulating load in the mill solutions. However, a few tons of potassium sulfate were produced, representing the excess potassium sulfate in the crude ore milled over and above the actual potash reagent requirements. None of the products were sold.

A brief report, with a geologic map of the Manning Creek alunite deposit, was published in 1945.[11] This deposit is about 7 miles east of Marysvale in an area of volcanic rocks. A total reserve of 800,000 tons was estimated for the two largest deposits.

No development work is known to have been done in 1945 in the Grand County potash field, eastern Utah.

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[9] Barr, J. A., Potash and Phosphate: Min. Cong. Jour., vol. 32, No. 2, February 1946, pp. 69–72.

[10] Mining World, Bonneville Potash: Vol. 7, No. 9, August 1945, pp. 27–32.

[11] Geological Survey, Preliminary Map 3–192, Strategic Minerals Investigations Series, 1945.

FOREIGN TRADE [12]

Imports.—Imports of potash salts continued at recent low levels in 1945, the total of 17,212 short tons (6,022 tons K_2O) imported being even below that of 1944. The total value of the imports, however, increased greatly, to $3,310,475 from $2,048,351 in 1944, because nearly double the amount of argols was imported in 1945 as came in during 1944. The U. S. S. R. was the principal source of the imports.

Potash (K_2O) for fertilizer use constituted only 64.3 percent of the total imports in 1945, whereas in 1944 fertilizers had formed 77.2 percent of the total. Imports for chemical use in 1945 rose to 35.7 percent of the total compared with 22.8 percent in 1944.

The principal potassium salt imported for fertilizer use was potassium chloride, which came almost entirely from the U. S. S. R.; the balance of less than 1 ton came from Canada. Imports of potassium-bearing materials for consumption in the chemical industries consisted largely of potassium bitartrate as argols and cream of tartar from numerous countries, but principally from France, Algeria, Argentina, Portugal, and French Morocco.

Potash materials imported for consumption in the United States, 1944–45, by countries, in short tons

[Figures in parentheses in column headings indicate, in percent, approximate equivalent as potash (K_2O)]

Country	Muriate (chloride) (56.4)	Bitartrate		Potassium sodium nitrate mixtures, crude (14)	Chlorate and perchlorate (36)	All other [1]	Total	
		Argols or wine lees (20)	Cream of tartar (25)				Short tons	Value
1944								
Algeria		3,223					3,223	$858,956
Argentina		999					999	281,114
Canada	1	2	3		61	2	69	24,138
Chile		32		9,407			9,439	289,831
Italy		119					119	29,101
Mexico		26					26	692
Portugal		513					513	178,237
Spain		110	258				368	234,698
U. S. S. R.	4,331						4,331	118,998
United Kingdom						17	17	15,610
Uruguay		37					37	16,976
	4,332	5,061	261	9,407	61	19	19,141	2,048,351
1945								
Algeria		1,885					1,885	458,816
Argentina		1,265					1,265	507,578
Canada	(2)	1			334	24	359	87,341
Chile		81					81	31,400
France		2,848					2,848	968,704
Italy		552					552	182,685
Mexico		5					5	3,025
Morocco, French		1,083					1,083	78,292
Portugal		1,194	43				1,237	364,914
Spain		717	55				772	304,794
Sweden					40	20	60	14,960
Tunisia		174					174	51,115
U. S. S. R.	6,861						6,861	230,361
United Kingdom						30	30	26,490
	6,861	9,805	98		374	74	17,212	3,310,475

[1] Approximate equivalent as potash (K_2O)—1944: 40 percent; 1945: 45 percent.
[2] Less than 1 ton.

[12] Figures on imports and exports (unless otherwise indicated) compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Potash materials imported for consumption in the United States, 1944–45

Material	Approximate equivalent as potash (K_2O) (percent)	1944				1945			
		Short tons	Approximate equivalent as potash (K_2O)		Value	Short tons	Approximate equivalent as potash (K_2O)		Value
			Short tons	Percent of total			Short tons	Percent of total	
Used chiefly in fertilizers:									
Muriate (chloride)	56.4	4,332	2,443	50.2	$119,041	6,861	3,870	64.3	$230,371
Potassium-sodium nitrate mixtures, crude	14.0	9,407	1,317	27.0	278,534	-------	-------	-------	----------
Other potash fertilizer material[1]	6.0	-------	-------	-------	----------	24	(2)	-------	343
Total fertilizer	----------	13,739	3,760	77.2	397,575	6,885	3,870	64.3	230,714
Used chiefly in chemical industries:									
Bitartrate:									
Argols	20.0	5,061	1,012		1,417,464	9,805	1,961		2,873,916
Cream of tartar	25.0	261	65		199,455	98	25		77,910
Caustic	80.0	-------	-------		----------	20	16		8,248
Chlorate and perchlorate	36.0	61	22	22.8	17,332	374	135	35.7	93,197
Ferricyanide (red prussiate)	42.0	1	(2)		1,433	-------	-------		----------
All other	50.0	18	9		15,092	30	15		26,490
Total chemical	----------	5,402	1,108	22.8	1,650,776	10,327	2,152	35.7	3,079,761
Grand total	----------	19,141	4,868	100.0	2,048,351	17,212	6,022	100.0	3,310,475

[1] Chiefly wood ashes from Canada. [2] Less than 1 ton.

A slight change has been made in the import tables in the content of K_2O assigned to "Other potash fertilizer material." Dr. A. R. Merz of the Tariff Commission suggested that, insomuch as the material now imported under this classification is chiefly wood ashes from Canada that 6 percent K_2O be used for that class instead of the 60 percent carried for many years, and the change was made.

Exports.—The total value of the domestic export trade in potash materials increased in 1945 to $6,635,785 from $6,281,727 in 1944, a decline being registered in the value of fertilizer potash materials exported, and a marked increase being shown in exports of chemical potash. The total quantity of fertilizer potash materials exported in 1945—104,687 short tons—was considerably less than in 1944, and the value fell below $3,000,000. The fertilizer exports went largely to Canada (82,302 tons), with smaller quantities to numerous other countries. Exports of chemical potash materials increased in 1945 to 18,966 tons, with a value of $3,648,795. The principal potash-fertilizer material exported was potassium chloride; the principal potash chemicals exported were, in order of size, the hydroxide (caustic potash), nitrate and mixtures, and carbonate and mixtures. Canada, United Kingdom, Brazil, and the U. S. S. R., in the order named, were the leading recipients of the potash chemicals exported in 1945.

Potash materials exported from the United States, 1941–45

Year	Fertilizer		Chemical		Year	Fertilizer		Chemical	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1941	91,950	$2,592,697	12,883	$2,972,137	1944	110,057	$3,139,631	15,444	$3,142,096
1942	84,402	2,184,044	13,307	3,611,656	1945	104,687	2,986,990	18,966	3,648,795
1943	111,541	3,168,446	20,133	3,950,542					

Potash materials exported from the United States, 1944–45, by countries

Country	Fertilizers				Chemicals			
	1944		1945		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Algeria					398	$115,745	190	$62,045
Argentina	(1)	$65	(1)	$98	167	27,718	318	57,103
Australia			(1)	80	518	96,591	700	103,188
Barbados	5,163	178,107	3,149	108,099			(1)	58
Belgian Congo					177	48,390	37	9,218
Brazil	1,517	60,925	3,524	150,784	2,301	500,852	1,735	339,106
Canada	85,215	2,280,190	82,302	2,219,583	3,065	464,981	3,052	493,934
Chile	(1)	8	(1)	1	213	65,851	168	51,595
Colombia	406	15,761	966	33,369	332	87,923	328	92,714
Costa Rica	450	17,054	(1)	18	38	14,420	32	12,250
Cuba	5,958	211,530	7,681	255,059	150	70,087	188	70,052
Egypt	(1)	42			152	50,169	212	46,993
Iceland	220	8,070	277	10,216	24	4,969	53	12,156
India and Dependencies					256	90,870	268	102,562
Iran					180	50,762	87	34,663
Mexico	564	8,445	927	21,996	906	217,498	1,143	281,409
Morocco, French			(1)	3	104	27,134	222	32,424
New Zealand	4,072	124,296	3,568	99,525	38	7,680	55	8,845
Sweden					4	11,093	1,137	237,285
Switzerland							1,026	181,428
Union of South Africa	111	6,560	104	4,263	283	95,660	374	85,023
U. S. S. R.					1,567	328,960	1,500	278,449
United Kingdom	4,672	153,729			3,953	548,472	2,067	299,783
Uruguay					53	16,365	67	20,418
Venezuela	72	3,175	60	2,699	93	27,293	123	30,881
Other countries	1,637	71,674	2,129	81,197	472	172,613	3,884	705,213
	110,057	3,139,631	104,687	2,986,990	15,444	3,142,096	18,966	3,648,795

[1] Less than 1 ton.

Potash materials exported from the United States in 1945, by countries and classes, in short tons

Country	Fertilizers				
	Chloride	Sulfate	Potassic fertilizer material [1]	Other [2]	Total fertilizers
Australia	(3)				(3)
Barbados	3,149				3,149
Brazil	3,224	300			3,524
Canada	65,449	6,938	9,915		82,302
Chile	(3)				(3)
Colombia	966				966
Cuba	6,420	1,261			7,681
Mexico	574	(3)	353	(3)	927
New Zealand	3,318	250			3,568
Peru	1,105	(3)			1,105
Union of South Africa	24	80			104
Venezuela		60			60
Other countries	1,116	132	53		1,301
Total: Short tons	85,345	9,021	10,321	(3)	104,687
Value	$2,504,731	$331,441	$150,758	$60	$2,986,990

See footnotes at end of table.

Potash materials exported from the United States in 1945, by countries and classes, in short tons—Continued

Country	Chemicals					
	Potassium iodides	Bichromate and chromate	Hydroxide (caustic potash)	Carbonate and mixtures	Bitartrate and mixtures	Chlorate and mixtures
Algeria	4	(3)	26	13	(3)	16
Argentina	(3)	6	297	(3)	(3)	---
Australia	1	---	414	271	---	(3)
Belgian Congo	(3)	(3)	12	(3)	(3)	(3)
Brazil	6	57	100	222	(3)	274
Canada	1	122	1,388	95	26	2
Chile	(3)	13	29	35	(3)	(3)
Colombia	1	2	16	11	5	161
Costa Rica	(3)	1	3	(3)	2	20
Cuba	2	2	13	6	13	88
Egypt	(2)	9	36	77	1	86
Iceland	(3)	1	35	6	1	(3)
India and Dependencies	1	(3)	104	(3)	---	1
Iran	1	---	1	(3)	1	84
Mexico	3	38	76	193	1	545
Morocco, French	1	3	214	(3)	(3)	3
New Zealand	---	---	49	6	(3)	(3)
Sweden	17	---	784	221	---	---
Switzerland	11	---	766	199	---	---
Union of South Africa	1	1	231	79	---	3
U. S. S. R.	---	400	78	---	(3)	95
United Kingdom	(3)	---	2,067	---	---	---
Uruguay	2	9	28	5	(3)	11
Venezuela	1	2	45	1	2	6
Other countries	16	79	1,551	1,426	16	217
Total: Short tons	69	745	8,363	2,866	68	1,612
Value	$202,390	$165,235	$1,186,915	$405,690	$81,464	$479,495

Country	Chemicals—Continued					
	Cyanide and mixtures	Nitrate and mixtures	Permanganate and mixtures	Rochelle salts	Other	Total chemicals
Algeria	1	1	(3)	---	129	190
Argentina	1	2	5	---	7	318
Australia	---	---	3	---	11	700
Belgian Congo	(3)	24	---	(3)	1	37
Brazil	8	1,015	5	(3)	48	1,735
Canada	6	849	27	1	535	3,052
Chile	(3)	(3)	1	(3)	90	168
Colombia	(3)	112	3	1	16	328
Costa Rica	(3)	6	(3)	(3)	(3)	32
Cuba	2	49	4	3	6	188
Egypt	(3)	(3)	(3)	---	3	212
Iceland	---	10	---	---	(3)	53
India and Dependencies	13	(3)	30	---	119	268
Iran	(3)	---	(3)	---	(3)	87
Mexico	9	210	30	(3)	38	1,143
Morocco, French	---	(3)	1	(3)	(3)	222
New Zealand	---	---	---	---	(3)	55
Sweden	17	48	11	---	39	1,137
Switzerland	---	44	1	---	5	1,026
Union of South Africa	(3)	24	1	(3)	34	374
U. S. S. R.	---	916	11	(3)	(3)	1,500
United Kingdom	---	---	---	---	(3)	2,067
Uruguay	---	3	1	(3)	8	67
Venezuela	(3)	61	2	1	2	123
Other countries	6	393	10	1	169	3,884
Total: Short tons	63	3,767	146	7	1,260	18,966
Value	$49,388	$557,544	$53,164	$6,436	$431,074	$3,648,795

1 Containing 20 percent or more potassium oxide (K_2O) equivalent (25 percent K_2O-content equivalent basis).
2 Containing less than 20 percent potassium oxide (K_2O)-equivalent basis.
3 Less than 1 ton.

WORLD PRODUCTION

Little statistical information is available regarding potash production in foreign countries in recent years, although operations have been in progress in various countries. Such official information as is available is included in the accompanying world production table. Soviet Russia, with its large reserves in the Solikamsk region, the former Polish potash fields, and its recently acquired predominant control of the former German potash production, has intensified its control of the potash industry of eastern Europe. The smaller remainder of the productive area of Germany is distributed among the British, American, and French zones of occupation.

Potash beds containing the potassium minerals sylvite and polyhalite were discovered during wartime oil-well drilling in North Yorkshire, England, at a reported depth of 4,000 feet. They are considered by the concessionaires to be too deep for profitable extraction. It has been suggested that these beds may be the continuation of the potash deposits of northwestern Germany.

A detailed description of the Lake Campion, Western Australia, alunitic clay deposit, the mining operations, and the method of treatment of the material for the recovery of potassium-sodium sulfate is given in an article by Fitzgerald [13] published early in 1945.

An article by Holloway [14] on Eritrea contains a geologic map of Eritrea and part of Ethiopia, covering the formerly productive potash area. A later report by the same author [15] describes the potash deposits.

The Spanish potash deposits were described in the June, 1945, issue of Minería y Metalurgia.[16]

The international position of the potash industry was discussed by Marcus Nadler [17] in a report released by the American Potash Institute early in 1946.

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[13] Fitzgerald, M. L., Production of Potash from Alunite: Chem. Eng., and Min. Review, vol. 37, No. 440, May 10, 1945, pp. 241–248.

[14] Holloway, H. L., Eritrea: Min. Mag., vol. 73, No. 2, 1945, pp. 72–81.

[15] Holloway, H. L., Salt Deposits of the Dankalian Depression: Min. Mag., vol. 73, No. 4, 1945, pp. 211–216.

[16] Minería y Metalurgia, Las sales potasicas en Cataluña: 2d epoch, No. 50, Madrid, June 1945, pp. 7–19.

[17] Nadler, Marcus, International Position of the Potash Industry, in Backman, Jules, The Economics of the Potash Industry: Am. Potash Inst., Inc., Washington, D. C., 1946, pp. 51–55.

World production of potash minerals and equivalent K_2O, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country and mineral [1]	1938		1939		1940		1941	
	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O
North America: United States, potassium salts	485, 291	287, 532	496, 007	283, 223	597, 150	344, 437	894, 895	476, 156
South America: Chile, crude potassium nitrate	(2)	(2)	(2)	(2)	62, 208	8, 585	(2)	(2)
Europe:								
France (Alsace), crude potassium salts	3, 374, 811	581, 790	3, 517, 382	[3] 598, 000	3, 143, 754	[3] 534, 400	4, 235, 426	[3] 720, 000
Germany, crude potassium salts:								
Carnallite [4]	1, 874, 375	2, 179, 871	15, 902, 307	2, 061, 734	16, 209, 372	2, 065, 479	17, 223, 917	2, 171, 358
Kainite, sylvinite, and hartsalz	14, 567, 896							
Italy, alunite	2, 778	333	3, 819	458	5, 610	673		
Poland, crude potassium salts:								
Kainite	120, 100	12, 010	(2)	(2)	(2)	(2)	(2)	(2)
Sylvite	427, 200	93, 984	(2)	(2)	(2)	(2)	(2)	(2)
Langbeinite	19, 644	2, 358	(2)	(2)	(2)	(2)	(2)	(2)
Spain, crude potassium salts	[5] 49, 572	(2)	[5] 143, 393	25, 526	[5] 291, 373	89, 653	[5] 314, 938	117, 000
U. S. S. R., crude potassium salts	(2)	[7] 122, 000	(2)	(2)	(2)	(2)	(2)	(2)
Asia:								
China, potash	[8] 14	(2)	[8] 4	(2)	3, 317	(2)	(2)	(2)
India (British), nitrate of potash	[7] 8, 200	[7] 4, 000	8, 697	4, 175	[9] 13, 206	[9] 6, 340	11, 063	5, 310
Korea (Chosen), alunite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Palestine, crude potassium salts [10]	58, 118	29, 059	[11] 63, 527	31, 764	88, 961	44, 480	101, 681	50, 840
Africa: Eritrea, niccoli salts [12]	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Australia, alunite	445	(2)	762	(2)	800	(2)	1, 181	(2)

See footnotes at end of table.

World production of potash minerals and equivalent K_2O, 1938–45, by countries, in metric tons [1]—Continued

Country and mineral [1]	1942		1943		1944		1945	
	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O	Output	Equivalent K_2O
North America: United States, potassium salts	1,149,810	616,162	1,296,215	670,534	1,431,982	757,103	1,440,879	793,096
South America: Chile, crude potassium nitrate	63,828	(2)	63,828	(2)	(2)	(2)	(2)	(2)
Europe:								
France (Alsace), crude potassium salts	3,835,395	[3] 652,000	4,195,111	[3] 713,200	2,945,346	[3] 500,700	(2)	(2)
Germany, crude potassium salts:								
Carnallite [4} / Kainite, sylvinite, and hartsalz	16,802,179	2,078,785	16,976,952	2,086,639	15,861,933	1,925,530	(2)	(2)
Italy, alunite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Poland, crude potassium salts:								
Kainite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Sylvite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Langbeinite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Spain, crude potassium salts	[5] 413,799	89,654	[5] 439,657	87,000	[5] 675,836	[6] 116,000	[6] 718,700	[6] 115,000
U. S. S. R., crude potassium salts	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Asia:								
China, potash	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
India (British), nitrate of potash	7,110	3,410	(2)	(2)	(2)	(2)	(2)	(2)
Korea (Chosen), alunite	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Palestine, crude potassium salts [10]	104,200	52,100	93,750	46,900	(2)	(2)	(2)	(2)
Africa: Eritrea, niccoli salts [12]	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Australia, alunite	4,784	(2)	435	(2)	(2)	(2)	(2)	(2)

[1] In addition to countries listed Iran is reported to produce a small quantity of potash salts, but statistics of production are not available.
[2] Data not available.
[3] Equivalent K_2O content estimated at approximately 17 percent.
[4] Includes some natural kieserite.
[5] Salable.
[6] Unofficial estimate.
[7] Estimated production (Imperial Institute, London).
[8] Exports of potassium carbonate.
[9] Fiscal year ending March 31 of year stated.
[10] Extracted from waters of Dead Sea.
[11] Exports.
[12] Extracted from waters of Red Sea.

MICA

By G. Richards Gwinn and E. M. Tucker

SUMMARY OUTLINE

SUMMARY

Domestic production and consumption of all kinds of mica decreased in 1945. Domestic production supplied 13 percent of all receipts of the strategic grades of muscovite block and film for the first 6 months of 1945; however, the curtailment of the Colonial Mica Corporation's domestic mica-buying program, which began with the first of the year, and its complete cancellation due to the cessation of hostilities toward the end of the year eliminated almost entirely the production of domestic ruby block mica of the better grades by the end of 1945. The abridgment and final revocation of the Colonial Mica Corporation's domestic mica-buying program was based on recommendations of the War Production Board because of the favorable supply position and the decreased consumption of mica in the war program.

The major mica-producing countries of the world in 1945, as in the previous year, were India and Brazil. Production of phlogopite mica in Madagascar was reduced by the exorbitant prices fixed by the Madagascar Office of Economic Affairs, which were not acceptable to American and British buyers.

WPB Conservation Orders M-101 and M-101a, covering the allocation and control, respectively, of block mica and mica splittings, were revoked August 21, 1945. However, the Government buying program in Brazil and India continued until November 30, 1945, and African mica was under control of the British Government until December 31, 1945. The WPB continued allocation control over block and splitting mica to assure industry adequate supplies of mica until private purchase could be resumed.

A study of the color classification of muscovite mica used by the consuming industry was made by the National Bureau of Standards in 1945 at the request of the WPB and the Metals Reserve Company. The results of this study, which set up in fundamental terms a color standard for ruby mica that previously existed only in the memories of mica inspectors, have recently been released.[1]

A shortage of ground mica of roofing-grade quality, used in the preparation of asphalt landing mats for the armed services, developed in the first quarter of 1945; but, as it was primarily a shortage of the finished product and not the raw material, the supply was increased to adequate proportions in a few months. In the interest of a continuing domestic mica industry, it is hoped that private buyers will require at least three-quarter trim material. Otherwise the advancements in mining and processing of domestic mica gained during the war period will be lost, and the production of sheet mica will fall to a level lower than that of the years immediately preceding World War II.

The accompanying table of salient statistics summarizes domestic production and total supply of mica available in the United States during the past 5 years.

Salient statistics of the mica industry in the United States, 1941–45

	1941	1942	1943	1944	1945
Domestic mica sold or used by producers:					
Total uncut sheet and punch:					
Pounds	2,666,453	2,761,844	3,448,199	1,523,313	1,298,587
Value	$566,858	$725,030	$3,228,742	$3,262,711	$737,342
Average per pound	$0.21	$0.26	$0.94	$2.14	$0.57
Scrap:[1]					
Short tons	32,500	43,262	46,138	51,727	32,880
Value	$442,789	$671,165	$738,025	$1,089,072	$509,600
Average per ton	$13.62	$15.51	$16.00	$21.05	$15.50
Total sheet and scrap:[1]					
Short tons	33,833	44,643	47,862	52,489	33,529
Value	$1,009,647	$1,396,195	$3,966,767	$4,351,783	$1,246,942
Total ground:[1]					
Short tons	43,419	46,979	51,582	52,713	48,224
Value	$1,532,351	$1,653,358	$1,990,144	$1,914,709	$1,990,596
Consumption of splittings:					
Pounds	7,297,628	6,636,639	8,413,362	8,816,965	7,897,402
Value	$2,832,939	$2,835,421	$3,518,822	$4,657,730	$3,415,696
Imports for consumption:					
Total uncut sheet and punch:					
Pounds	2,016,852	3,244,857	5,501,745	5,032,983	4,284,720
Value	$1,119,584	$2,141,465	$6,313,900	$3,921,078	$4,125,016
Scrap:					
Short tons	1,251	2,179	2,048	2,412	3,567
Value	$12,791	$25,879	$27,102	$32,688	$41,410
Total sheet and scrap:					
Short tons	2,259	3,801	4,799	4,928	5,709
Value	$1,132,375	$2,167,344	$6,341,002	$3,953,766	$4,166,426
Manufactured:					
Short tons	6,041	7,493	8,960	2,314	3,695
Value	$3,282,656	$6,860,434	$8,513,064	$3,707,718	$2,172,333
Total imports:					
Short tons	8,300	11,294	13,759	7,242	9,405
Value	$4,415,031	$9,027,778	$14,854,066	$7,661,484	$6,338,759
Exports (all classes of mica):					
Short tons	1,163	1,001	693	619	981
Value	$280,810	$303,526	$653,889	$526,824	$377,473

[1] Includes mica recovered from kaolin and mica schists.

[1] Judd, D. B., Color Standard for Ruby Mica: Nat. Bureau of Standards Research Paper 1671, 1945, 12 pp.

DOMESTIC PRODUCTION

Sheet mica.—The quantity of sheet and punch mica produced in 1945 amounted to 1,298,587 pounds valued at $737,342 compared with 1,523,313 pounds valued at $3,262,711 in 1944. Punch mica supplied 90 percent of the 1945 total or 1,166,858 pounds valued at $166,116 compared with 55 percent of the 1944 production or 835,402 pounds valued at $147,635. In 1945 North Carolina was the largest producer of uncut mica larger than punch or circle, supplying 55 percent of the total, and New Hampshire was the largest producer of punch and circle, supplying 45 percent of the total.

The sharp reduction in output of sheet and punch mica in 1945 is attributed to the reduced consumption of mica by the armed forces. This brought about an increasingly favorable supply position, which in turn caused a gradual reduction and finally cancellation of the Colonial Mica Corporation's domestic mica-buying program. Private purchasers could not match the subsidized Government prices, and as only a few operators could meet the rigid specifications required by the Colonial Mica Corporation large numbers of the mines were closed.

Mica sold or used by producers in the United States, 1935–39 (average) and 1939–45

Year	Sheet mica						Scrap mica and mica recovered from kaolin and schists		Total	
	Uncut punch and circle mica		Uncut mica larger than punch and circle		Total uncut sheet mica [1]					
	Pounds	Value	Pounds	Value	Pounds	Value	Short tons	Value	Short tons	Value
1935–39 (average)	888,313	$46,408	252,411	$139,306	1,140,724	$185,714	21,986	$285,512	22,557	$471,226
1939	665,755	39,207	147,953	99,756	813,708	138,963	24,672	311,895	25,079	450,858
1940	1,405,305	116,087	220,132	175,598	1,625,437	291,685	22,386	314,565	23,199	606,250
1941	2,342,237	206,947	324,216	359,911	2,666,453	566,858	32,500	442,789	33,833	1,009,647
1942	2,425,645	282,900	336,199	442,130	2,761,844	725,030	43,262	671,165	44,643	1,396,195
1943	2,691,083	473,955	757,116	2,754,787	3,448,199	3,228,742	46,138	738,025	47,862	3,966,767
1944:										
Connecticut	26,219	9,558	50,857	137,571	77,076	147,129	593	13,798	632	160,927
Georgia	39,108	3,647	21,004	115,695	60,112	119,342	5,305	107,135	5,335	226,477
New Hampshire	194,538	57,010	129,098	560,162	323,636	617,172	2,339	55,851	2,501	673,023
North Carolina	474,680	69,025	340,195	1,461,600	814,874	1,530,625	29,774	750,285	30,181	2,280,910
South Dakota	65,649	3,240	80,734	468,786	146,383	472,026	2,558	51,405	2,631	523,431
Other States [2]	35,208	5,155	66,024	371,262	101,232	376,417	11,158	110,598	11,209	487,015
	835,402	147,635	687,911	3,115,076	1,523,313	3,262,711	51,727	1,089,072	52,489	4,351,783
1945:										
Connecticut	60,823	3,246	1,009	6,879	61,832	10,125	70	1,752	101	11,877
Idaho	33,948	11,510	14,070	99,498	48,018	111,008	199	3,178	223	114,186
New Hampshire	519,343	53,593	13,601	91,354	532,944	144,947	442	11,206	708	156,153
North Carolina	491,428	82,292	72,562	160,766	563,990	243,058	22,502	406,612	22,784	649,670
South Dakota	32,506	9,727	24,064	168,969	56,570	178,696	1,192	21,534	1,220	200,230
Other States [2]	28,810	5,748	6,423	43,760	35,233	49,508	8,475	65,318	8,493	114,826
	1,166,858	166,116	131,729	571,226	1,298,587	737,342	32,880	509,600	33,529	1,246,942

[1] Includes small quantities of splittings in certain years.
[2] 1944: Alabama, Arizona, Colorado, Idaho, Maine, Massachusetts, Montana, Nevada, New Mexico, Pennsylvania, Virginia, and Wyoming; 1945: Alabama, Arizona, California, Colorado, Georgia, Maine, Massachusetts, Nevada, New Mexico, Pennsylvania, South Carolina, Virginia, and Wyoming.

The production of sheet and punch mica is not segregated into clear and stained material on Bureau of Mines annual reports. An index of the quantities of these classes mined may be obtained, however, from the statistics of purchases of clear and stained mica, as indicated on a quarterly basis in figure 1.

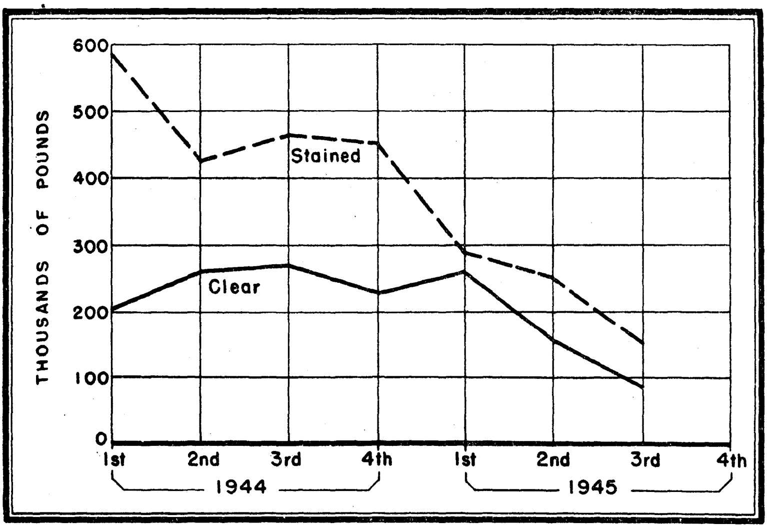

FIGURE 1.—Average monthly purchases of domestic sheet mica, clear and stained, for each quarter of 1944 and the first three quarters of 1945.

Scrap mica.—Production of scrap mica in 1945 amounted to 32,880 short tons valued at $509,600 compared with 51,727 tons valued at $1,089,072 in 1944. In addition to mine and factory scrap, these figures include 7,152 tons valued at $23,223 of mica reclaimed from the washing of kaolin and by milling mica schists. Although the product obtained in reclaiming operations is a ground mica, it represents an original recovery of mica. The production of scrap and reclaimed mica from 1940 through 1945 and the 1935–39 average are given in the following table.

Scrap and reclaimed mica sold or used by producers in the United States, 1935–39 (average) and 1940–45

Year	Scrap		Reclaimed		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1935–39 (average)	13,582	$168,688	8,404	$116,824	21,986	$285,512
1940	12,712	176,417	9,674	138,148	22,386	314,565
1941	16,917	257,303	15,583	185,486	32,500	442,789
1942	22,781	355,358	20,481	315,807	43,262	671,165
1943	22,025	423,174	24,113	314,851	46,138	738,025
1944	29,620	603,505	22,107	485,567	51,727	1,089,072
1945	25,728	486,377	7,152	23,223	32,880	509,600

Ground mica.—Total output of ground mica in 1945 reached 48,224 short tons, valued at $1,990,596, and represents a 9-percent decrease from the record high of 52,713 tons, valued at $1,914,709, in 1944.

The roofing industry consumes a major part of the dry ground-mica production, and the paint, rubber, wallpaper, and lubricant manufacturers utilize most of the wet-ground product. It is claimed that wet-ground mica used in paints to give flexibility to the film increases the life of the paint. It may be substituted in part or entirely for magnesium silicate and basic carbonate white lead and for a small part of the titanium dioxide. In wallpaper the glossy, water-ground flakes increase light reflection. The rubber industry utilizes ground mica chiefly as a dusting powder to prevent sticking.

The history of the scrap- and ground-mica industries over a series of years is indicated in figure 2.

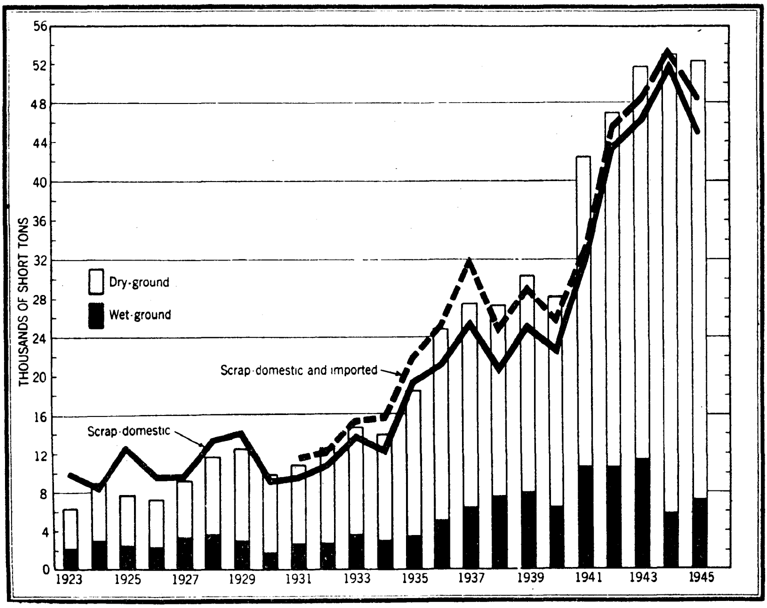

FIGURE 2.—Scrap and ground mica sold in the United States 1923–45.

Ground mica (including mica from kaolin and schists) sold by producers in the United States to various industries, 1944–45

Industry	1944			1945		
	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total	
Roofing	21,280	40	$495,431	24,825	51	$705,802
Wallpaper	1,325	3	123,180	1,911	4	139,719
Rubber	1,137	2	95,689	3,715	7	241,657
Paint	5,107	10	329,905	7,570	15	382,992
Plastics	1,079	2	95,887	990	3	83,941
Miscellaneous [1]	22,785	43	774,617	9,213	20	436,485
	52,713	100	1,914,709	48,224	100	1,990,596

[1] Includes mica used for molded electric insulation, house insulation, Christmas-tree snow, manufacture of axle greases and oil, annealing, pipe-line enamel, textiles, oil-well drilling, welding, and other purposes.

Ground mica (including mica from kaolin and schists) sold by producers in the United States, 1941-45, by methods of grinding

Year	Dry-ground		Wet-ground		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	31,914	$733,559	11,505	$798,792	43,419	$1,532,351
1942	36,369	805,163	10,610	848,195	46,979	1,653,358
1943	40,256	1,027,781	11,326	962,363	51,582	1,990,144
1944	47,023	1,382,147	5,690	532,562	52,713	1,914,709
1945	40,891	1,316,702	7,333	673,894	48,224	1,990,596

The total production of sheet, punch, and scrap mica in the United States from 1941 through 1945, by districts, is given in the following table. States in the districts are as follows: Northeastern—Connecticut, Maine, Massachusetts, New Hampshire, New York, and Vermont; Southeastern—Alabama, Georgia, Maryland, North Carolina, Pennsylvania, South Carolina, and Virginia; Black Hills—South

Sheet, punch, and scrap mica sold or used in the United States, 1941-45, by districts

	1941	1942	1943	1944	1945	Total
Sheet:						
Southeastern:						
Pounds	183,682	220,108	403,257	376,757	78,510	1,262,314
Value	$201,492	$355,149	$1,804,247	$1,642,278	$201,595	$4,204,761
Northeastern:						
Pounds	127,729	78,108	259,584	189,492	14,624	669,537
Value	$149,083	$49,411	$511,633	$745,157	$98,347	$1,553,631
Southwestern:						
Pounds		2,663	4,112	1,965	390	9,130
Value		$1,726	$18,433	$11,784	$2,660	$34,603
Northwestern:						
Pounds		5	5,228	38,963	14,141	58,337
Value		$2	$25,939	$247,071	$99,655	$372,667
Black Hills:						
Pounds	12,805	35,315	84,935	80,734	24,064	237,853
Value	$9,336	$35,842	$394,535	$468,786	$168,969	$1,077,468
Punch:						
Southeastern:						
Pounds	1,527,085	1,563,538	1,729,573	514,698	520,118	5,855,012
Value	$130,788	$200,326	$203,358	$72,768	$87,970	$695,210
Northeastern:						
Pounds	528,921	489,436	709,740	240,546	580,166	2,548,809
Value	$47,546	$41,331	$216,160	$67,822	$56,839	$429,698
Southwestern:						
Pounds	343	8,762	2,627	4,375		16,107
Value	$24	$1,398	$1,596	$1,750		$4,768
Northwestern:						
Pounds			654	10,134	34,068	44,856
Value			$167	$2,055	$11,580	$13,802
Black Hills:						
Pounds	285,888	363,909	248,489	65,649	32,506	996,441
Value	$28,589	$39,845	$52,674	$3,240	$9,727	$134,075
Scrap:						
Southeastern:						
Short tons	25,431	30,400	33,317	37,161	23,780	150,089
Value	$360,879	$545,329	$589,485	$899,902	$430,542	$2,826,137
Northeastern:						
Short tons	1,166	864	1,782	3,114	547	7,473
Value	$17,578	$17,473	$43,550	$74,200	$13,797	$166,598
Southwestern:						
Short tons	4,252	9,453	8,730	8,456	7,082	37,973
Value	$36,396	$63,784	$61,372	$55,420	$39,749	$256,721
Northwestern:						
Short tons	40		75	438	279	832
Value	$320		$854	$8,145	$3,978	$13,297
Black Hills:						
Short tons	1,611	2,545	2,234	2,558	1,192	10,140
Value	$27,616	$44,579	$42,764	$51,405	$21,534	$187,898

Dakota; Northwestern—Idaho, Montana, Nevada, and Wyoming; Southwestern—Arizona, California, Colorado, New Mexico, and Texas. All the States in each district are not represented in each year's production but reported output in at least 1 year of the reporting period.

It is apparent from this table that the Southeastern district is the principal producer of sheet. Of the total output of punch mica, New England contributed 50 percent and the Southeastern district 45 percent in 1945.

The Southeastern district produces the bulk of the scrap mica recovered and therefore is the seat of most of the mica-grinding mills.

TOTAL CONSUMPTION OF BLOCK AND SHEET MICA

The sharp reduction in the consumption of block and sheet mica is attributed primarily to the reduction in requirements of the armed forces because of the substitution of glass and ceramic components for mica in radio condensers and spark plugs. Our total supply position thus became more favorable. However, some sizes of mica sheet remained in short supply throughout the year. It is true that larger sizes and better qualities may be substituted for smaller sizes and poorer qualities, but the potential relief is limited by the smaller quantities of the better qualities and sizes available. The margin of safety in supplies however was such that the United States Government and that of Great Britain withdrew from the markets in Argentina, Canada, Peru, and Mexico early in 1945 in order to return those markets to private buying. Private purchase in Brazil was made possible by the end of September 1945, and the importation of mica of all classes was released from the restriction of WPB General Import Order M–63 at approximately that same date.

Figure 3 summarizes graphically the situation with respect to imports and domestic production.

A summary of domestic production of sheet and punch mica and the apparent United States consumption of sheet, punch, and splittings from 1935 to 1945 is given in the following table.

Production of sheet and punch mica and apparent consumption of sheet and punch mica and mica splittings in the United States, 1935–45

Year	Production	Apparent consumption	Year	Production	Apparent consumption
	Pounds	Pounds		Pounds	Pounds
1935	936, 633	4, 123, 659	1941	2, 666, 453	10, 087, 576
1936	1, 319, 233	5, 721, 685	1942	2, 761, 844	10, 344, 973
1937	1, 694, 538	7, 160, 616	1943	3, 448, 199	12, 355, 896
1938	939, 507	3, 029, 447	1944	1, 523, 313	7, 791, 898
1939	813, 708	5, 147, 448	1945	1, 298, 587	6, 285, 867
1940	1, 625, 437	8, 093, 174			

The average yearly domestic production for the 1935–39 period was 1,140,724 pounds, and yearly consumption averaged 5,036,571 pounds or a self-sufficiency percentage of 23 from domestic production for the period. Comparable figures for 1941–45 are 2,339,679 pounds of domestically produced punch and sheet and 9,373,242 pounds consumed yearly, or a self-sufficiency of 25 percent. Figures for the latter period emphasize the large quantities of mica consumed during the war years, and our continued dependence on foreign sources for the major portion of our supplies.

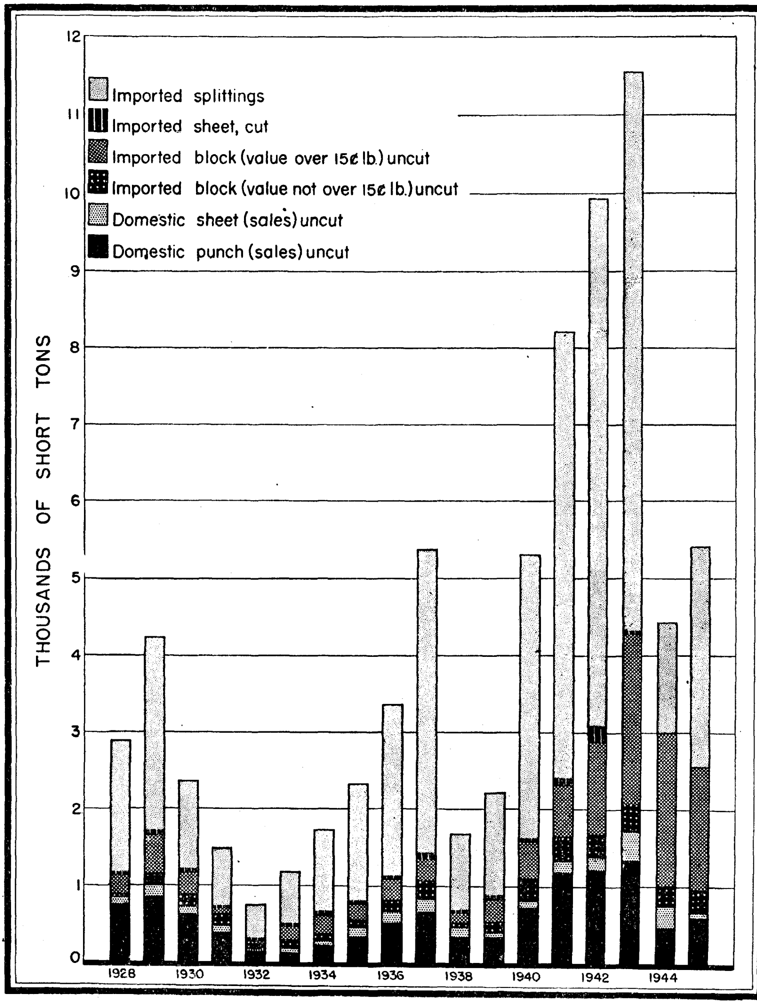

FIGURE 3—Block and sheet mica (cut) and splittings imported for consumption in the United States, and sales of domestic sheet and punch mica, 1928–45.

MICA SPLITTINGS

The consumption of mica splittings in the United States in 1945 reached 7,897,402 pounds valued at $3,415,696, a quantity 10 percent below the record high of 8,816,965 pounds valued at $4,657,730 in 1944.

Stocks of splittings decreased in 1945. Although industry stocks decreased only 23 percent from a January 1 figure of 3,994,977 pounds valued at $2,025,165 to a year-end total of 3,064,589 pounds valued at $1,391,617, Government stocks in the same period declined from 12,400,261 pounds to 4,710,426. Total stocks on hand at the end of 1945 were 7,775,015 pounds compared with 16,395,238 at the end of the last previous year.

Consumption and stocks of mica splittings in the United States, 1941–45, by sources, as reported by the consumers

Year	India		Canada		Madagascar		Total	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Consumption:								
1941	6,473,459	$2,334,432	179,783	$131,350	644,386	$367,157	7,297,628	$2,832,939
1942	5,998,614	2,415,709	117,295	79,752	520,730	339,960	6,636,639	2,835,421
1943	7,649,596	3,054,995	344,966	172,674	337,099	233,788	[1] 8,413,362	[1] 3,518,822
1944	7,708,253	4,002,010	601,661	324,631	371,972	251,945	[2] 8,816,965	[2] 4,657,730
1945	7,085,316	2,970,013	321,216	163,658	324,383	188,530	[3] 7,897,402	[3] 3,415,696
Stocks in consumers' hands Dec. 31:								
1941	9,212,891	3,434,336	115,529	81,988	223,235	134,143	9,551,655	3,650,467
1942	8,202,240	3,367,788	257,591	178,082	321,529	201,274	8,781,360	3,747,144
1943	4,031,849	1,708,096	138,564	85,893	215,639	139,797	[1] 4,517,211	[1] 2,032,758
1944	3,578,885	1,749,011	141,427	95,850	184,970	121,307	[2] 3,994,977	[2] 2,025,165
1945	2,684,848	1,145,176	143,102	91,115	193,763	130,661	[3] 3,064,589	[3] 1,391,617

[1] Consumption includes 26,510 pounds of domestic splittings and 55,191 pounds of Mexican splittings, valued at $11,308 and $46,057, respectively; stocks include 2,200 pounds of domestic splittings and 128,959 pounds of Mexican splittings, valued at $1,009 and $97,963, respectively.

[2] Consumption includes 58,350 pounds of domestic and 76,729 pounds of Mexican splittings, valued at $23,862 and $55,282, respectively; stocks include 3,694 pounds of domestic and 86,001 pounds of Mexican, valued at $1,365 and $57,632, respectively.

[3] Consumption includes 94,716 pounds of domestic and 71,771 pounds of Mexican splittings, valued at $46,731 and $46,764, respectively; stocks include 7,000 pounds of domestic and 35,876 pounds of Mexican, valued at $3,430 and $21,235, respectively.

Muscovite splittings made up 88 percent of the combined stocks. Although this percentage is somewhat above normal, it is explained by the decline in purchases, either public or private, of Madagascar splittings in 1945. WPB Order M–101a which limited the use of No. 5 or larger bookform muscovite splittings was revoked on August 21, 1945; however, splittings remained under allocation control as part of the Government's program to relieve civilian deficiencies of raw materials until private contracts can be completed. Peak consumption of muscovite splittings was reached in the second quarter. Amber splittings reached a peak in the second quarter also. Grade 6 loose splittings—first, second, and third quality—in 1945 constituted 77 percent of the total consumption of muscovite splittings.

Consumption of splittings from July 1944 through December 1945 is summarized graphically upon a quarterly basis in figure 4.

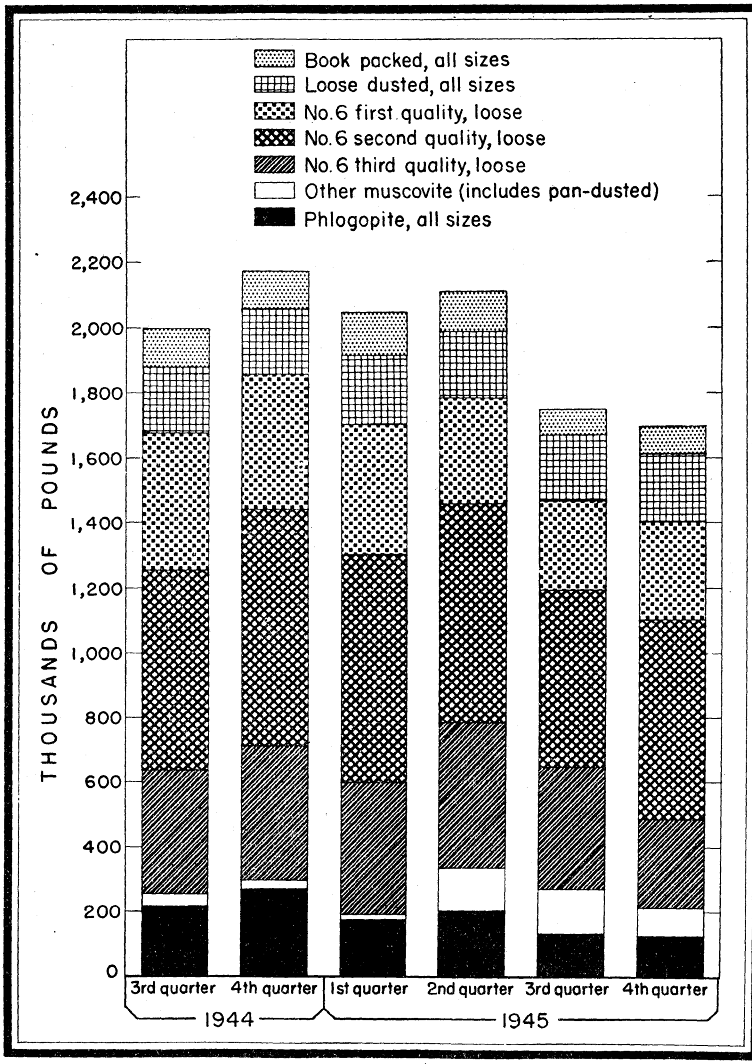

FIGURE 4.—Consumption of specified sizes and qualities of mica splittings in the United States, by quarters, July 1944 to December 1945.

BUILT-UP MICA

The consumption of built-up mica products in 1945 reached 7,194,909 pounds valued at $9,846,719, a decrease of 3 percent from the record high of 7,438,249 pounds valued at $10,143,873, reported in 1944. Part of the decrease may be attributed to the small quantity available of large-size, low-quality sheet, which is required for electrical appliances. During the war period specifications permitted the marketing of only the better grades; however the failure of industry to meet its quota of finished electrical appliances in 1945 cannot be attributed to the lack of mica but to a shortage of other components.

Built-up mica produced in the United States, 1944–45, by kinds of product[1]

Product	1944		1945	
	Pounds	Value	Pounds	Value
Molding plate	1,792,052	$1,816,920	2,015,993	$2,096,267
Segment plate	2,521,527	3,073,074	2,441,076	3,074,435
Heater plate	364,773	372,683	390,598	716,903
Flexible (cold)	817,255	1,004,719	775,342	955,126
All other (tape, etc)	1,942,642	3,876,477	1,571,900	3,003,988
	7,438,249	10,143,873	7,194,909	9,846,719

[1] Partly estimated.

PRICES

The wartime price schedule for sheet and punch mica, which was set up by the Colonial Mica Corporation in 1942, was abandoned on August 30, 1945. Specifications were changed at the first of the year, and although prices remained at $8 per pound for acceptable material the quantity of mica that could meet specifications was curtailed. At the end of the first quarter, the subsidized prices for domestic sheet mica were canceled.

During the second quarter, prices for domestic sheet were based on those paid by the United States Government for mica from foreign countries, plus import duty and an allowance of not less than 10 percent to cover charges incident to landing foreign purchases in the United States. This second-quarter schedule was later continued until the end of 1945. However, on August 30, 1945, the Colonial Mica Corporation announced termination of the domestic mica-purchasing program as of November 30, 1945. This date coincided with termination of all foreign purchasing agreements of the United States Government.

Prices for scrap mica in 1945 ranged from $17 per short ton f. o. b. mine in the Western States to $25 per ton in North Carolina and New England. Prices for ground mica, as quoted in the Oil, Paint and Drug Reporter, were as follows: Dry-ground, per ton f. o. b. mill—$30 to $45 in carlots and $35 to $48.50 in less than carlots, depending on the mesh size; wet-ground—freight allowed, $85 to $100 in carlots and $95 to $110 in less than carlots, depending on mesh size.

MICA SUBSTITUTES

Reports received near the end of 1945 gave a description of a mica substitute developed by the Germans. The trade name is Glushartgewebe. It consists of several layers of impregnated glass fiber bonded together by a homogeneous mixture of resinol alcohol and very finely divided kaolin. It is reported to be superior to mica.[2] A silicone rubber "silastic" developed recently at the Mellon Institute is also a satisfactory substitute for mica in certain applications.

[2] Chemical Age, German Insulating Material: Vol. 53, 1945, No. 1382, pp. 597–598.

The Germans also report the successful synthesis of mica. Blocks 3½ inches in diameter having the same cleavage as natural mica have been produced. Successful production is based on careful control in cooling the melt through the critical range of 1,270°–1,230° C. and the introduction of a magnetic field at right angles to the vertical axis of the crucible. The process has not been introduced to industry, however, as it is still in the laboratory stage.

FOREIGN TRADE[3]

Imports.—In 1945 imports of all kinds of mica totaled 9,405 short tons valued at $6,338,759 compared with 7,242 tons valued at $7,661,484 in 1944. Imports of all classes increased except untrimmed phlogopite (1 by 2 inches), unmanufactured "other" valued above 15 cents a pound, manufactured (cut or stamped) which declined greatly, and ground or pulverized mica. Further details on imports by kinds and sources of origin may be found in the following tables.

Mica imported for consumption in the United States in 1945,[1] by kinds and by countries

Country	Unmanufactured									
	Waste and scrap, valued not more than 5 cents per pound				Untrimmed phlogopite mica from which no rectangular piece exceeding in size 1 inch by 2 inches may be cut (duty, 10 percent)		Other			
	Phlogopite (duty, 15 percent)		Other (duty, 25 percent)				Valued not above 15 cents per pound n.e.s. (duty, 4 cents per pound)		Valued above 15 cents per pound (duty, 4 cents per pound+25 percent)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa:										
Belgian Congo									1, 111	$1, 055
British East Africa									3, 368	27, 035
Madagascar									7, 139	8, 169
Mozambique									7, 610	45, 458
Portuguese Guinea Angola									19, 632	58, 275
Union of South Africa			452, 875	$3, 248					539	4, 488
Argentina							55, 447	$5, 622	509, 713	477, 298
Bolivia									3, 135	4, 253
Brazil									1,523,514	1,391,869
Canada	4,325,588	$26, 651	454, 300	3, 533	489, 411	$56, 972	464, 862	41, 729	40, 296	110, 971
Guatemala									2, 549	1, 146
India and Dependencies							64, 262	9, 318	1,053,519	1,852,820
Mexico	872, 735	2, 427								
Peru			1,028,461	5, 551					37, 259	26, 507
Portugal									1, 354	2, 031
Total: 1945	5,198,323	29, 078	1,935,636	12, 332	489, 411	56, 972	584, 571	56, 669	3,210,738	4,011,375
1944	3,462,719	21, 763	1,361,357	10, 925	518, 195	74, 698	499, 331	36, 989	4,015,457	3,809,391

[1] Changes for table in Minerals Yearbook, 1944, p. 1480, are as follows—Other: Valued above 15 cents per pound imported from British East Africa should read 1.872 pounds valued at $1,872; Southern Rhodesia: None.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Mica imported for consumption in the United States in 1945, by kinds and by countries—Continued

Country	Manufactured—Films and splittings							
	Not cut or stamped to dimensions				Cut or stamped to dimensions (duty, 45 percent)		Total films and splittings	
	Not above 12 ten-thousandths of an inch in thickness (duty, 25 percent)		Over 12 ten-thousandths of an inch in thickness (duty, 40 percent)					
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Africa: Madagascar	180, 959	$66, 948					180, 959	$66, 948
Australia					190	$3, 345	190	3, 345
Canada	5, 865	3, 918					5, 865	3, 918
India and Dependencies	5, 526, 181	1, 510, 704	1, 211, 124	$407, 644			6, 737, 305	1, 918, 348
Mexico			64, 902	88, 020	10, 206	70, 663	75, 108	158, 683
Total: 1945	5, 713, 005	1, 581, 570	1, 276, 026	495, 664	10, 396	74, 008	6, 999, 427	2, 151, 242
1944	2, 856, 034	1, 355, 508	1, 082, 115	2, 002, 273	153, 472	319, 200	4, 091, 621	3, 676, 981

Country	Manufactured—Cut or stamped to dimensions, shape, or form (duty, 40 percent)		Manufactured—Other					
			Mica plates and built-up mica (duty, 40 percent)		All mica manufactures of which mica is the component material of chief value		Ground or pulverized (duty, 15 percent)	
	Pounds	Value	Pounds	Value	Pounds	Value	Pounds	Value
Australia			60	$1, 536				
Bolivia			1, 711	2, 091				
Brazil	4, 470	$2, 067						
Canada					319	$821	382, 466	$11, 042
Mexico	2, 000	3, 534						
Total: 1945	6, 470	5, 601	1, 771	3, 627	319	821	382, 466	11, 042
1944	5, 853	9, 225	399	5, 518			530, 909	15, 994

Exports.—Exports of unmanufactured mica in 1945 increased 34 percent in quantity over 1944 but decreased 33 percent in value. Canada, Mexico, Ecuador, and India were the chief foreign destinations. Exports of ground or pulverized mica increased greatly, but exports of other manufactured products declined. Details of exports appear in the following table.

Mica and manufactures of mica exported from the United States in 1945, by countries

Country	Unmanufactured		Manufactured			
			Ground or pulverized		Other	
	Pounds	Value	Pounds	Value	Pounds	Value
North America:						
Bermuda					2	$6
Canada[1]	183,992	$2,509	832,410	$38,830	127,309	217,934
Cuba			18,293	674	1,701	3,198
Mexico	27,356	9,264	17,242	898	8,349	15,321
Trinidad and Tobago			60,500	1,708	175	304
Other North America			1,308	168	1,368	2,711
South America:						
Argentina			11,525	389	286	414
Bolivia					50	155
Brazil			9,300	510	6,877	9,055
Chile	5,870	325	4,300	124	4,945	6,400
Colombia			19,600	1,475	1,869	1,803
Ecuador	30,006	902			19	68
Peru			2,520	153	664	1,618
Uruguay			500	30	116	496
Venezuela			345,840	9,209	144	299
Other South America	11	94			52	188
Europe:						
Spain					1,049	2,281
U. S. S. R					161	8,112
United Kingdom					2,590	5,657
Other Europe			6,201	300	344	662
Asia:						
China					1,062	1,756
India and Dependencies	35,800	1,650	52,200	2,095	342	906
Turkey					1,171	2,468
Other Asia			65	54	147	1,390
Africa:						
Algeria					6,725	11,383
French Morocco					728	963
Union of South Africa	2,000	100	114,200	3,594	9,582	5,315
Other Africa					506	1,069
Oceania			2,000	105	236	381
Total: 1945	285,035	14,844	1,498,004	60,316	178,569	302,313
1944	213,273	22,010	830,606	32,990	193,515	464,624

[1] Changes for table in Minerals Yearbook, 1944, p. 1481, are as follows: Value of ground or pulverized mica exported to Canada should read $23,745; total value should read $32,990.

WORLD PRODUCTION

Complete data on world production are not available; however with the lifting of Government and international controls and close cooperation from various countries of the world the amount of information available increased markedly, as indicated in the following table, showing production by countries, from 1938 to 1945.

World production of mica, 1938–45, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
North America:								
Canada (sales)	470	969	819	1,582	2,731	3,652	3,032	3,343
Guatemala	--------	--------	--------	--------	[2] 3	5	1	(3)
Mexico	(3)	(3)	[2] 39	[2] 36	44	104	[2] 111	409
United States (sold or used by producers) [4]	18,803	22,751	21,046	30,693	40.499	43,419	47,617	30,417
South America:								
Argentina	250	298	442	540	625	402	[5] 187	[6] 69
Bolivia (exports)	4	--------	1	3	3	2	2	(3)
Brazil (exports)	521	435	1,117	867	866	796	941	985
Peru	24	9	4	8	5	9	113	[5] 20
Europe:								
Italy	122	26	34	39	--------	--------	(3)	(3)
Norway	197	101	33	68	1,391	[2] 957	[2] 593	[2] 174
Portugal	--------	--------	--------	(3)	(3)	219	[5] 1,200	(3)
Rumania	22	18	(3)	(3)	(3)	(3)	(3)	(3)
Spain	--------	--------	20	215	334	387	239	[7] 33
Sweden	131	126	91	(3)	(3)	(3)	(3)	(3)
Asia:								
Ceylon	(8)	(8)	[2] 2	(8)	--------	2	2	1
India, British (exports)	8,896	10,104	8,654	10,584	8,729	9,382	(3)	(3)
Korea (Chosen)	159	(3)	(3)	(3)	(3)	(3)	449	(3)
Africa:								
British East Africa:								
Kenya							(8)	(3)
Tanganyika	21	30	9	4	12	41	[2] 128	(3)
Uganda							12	5
Eritrea	--------	10	7	--------	--------	--------	(3)	(3)
Ethiopia	(3)	(8)	2	1	(3)	(3)	(3)	(3)
Madagascar	677	590	531	479	320	343	493	[2] 248
Nigeria	3	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Portuguese East Africa	--------	17	(3)	--------	1	(3)	4	(3)
Portuguese West Africa	--------	(8)	2	1	(8)	1	4	(3)
Rhodesia:								
Northern	4	2	2	(8)	4	10	16	(3)
Southern	13	6	6	9	14	30	250	196
Union of South Africa: Transvaal	1,116	972	1,252	1,076	1,265	1,274	1,127	[7] 849
Oceania:								
Australia	74	88	106	128	206	88	129	(3)
New Zealand	(3)	1	--------	(3)	(3)	(8)	(8)	(3)

[1] In addition to the countries listed mica is also produced in Colombia, U. S. S. R., and Uruguay, but data on production are not available.
[2] Exports.
[3] Data not available.
[4] Includes following quantities recovered from kaolin and schists—1938: 5,942 tons; 1939: 9,082 tons; 1940: 8,776 tons; 1941: 14,137 tons; 1942: 18,580 tons; 1943: 21,875 tons; 1944: 20,055 tons; 1945: 6,488 tons.
[5] Estimate.
[6] January to June, inclusive.
[7] January to September, inclusive.
[8] Less than 1 ton.

Australia.—The increasing industrial demand during the war years for mica led to a thorough investigation of mica deposits in Australia. The Western Australian Department of Mines, in a recently issued bulletin, gives the location of deposits, percentage of sheet and scrap recovered, and lists of consumers of mica.[4]

Brazil.—Production of mica in Brazil reached an all-time high by the first quarter of 1945. Prospects for a large postwar industry are also favorable. The exploitation and development of Brazilian deposits by United States technicians have improved greatly the quantity of acceptable sheet and punch recovered. It seems probable, therefore, that the Brazilian mica industry is in a more favorable condition with respect to United States markets than any other foreign country.

[4] Matheson, R. S., Mineral Resources of Western Australia: Western Australia Dept. of Mines, Bull. 2, 1944, 35 pp.

Canada.—Production of muscovite and phlogopite sheet mica decreased in 1945. The Purdy mine, largest muscovite producer, virtually ceased operations in April; and the Kingston Mica Mining Co. of Ontario, one of the largest phlogopite operators, ceased operations December 31, 1944. The decrease in phlogopite production was offset to some extent, however, by the reopening of the General Electric Co. Lacey mine. Scrap mica continued in good demand, and large quantities were recovered from mine dumps.

Ceylon.—The mica industry in Ceylon at the end of 1945 was in a precarious position. The purchase of mica by the Anglo-American Mica Mission ceased on November 30, 1945, and by the end of the year 75 percent of the mica mines were closed. The Government ban on exports of mica from Ceylon has been lifted. However, the scarcity of skilled labor, the difficulty in obtaining a license for the necessary freight facilities, and the lack of capital in the hands of mica miners curtailed activity.

India.—Although the quantity of mica necessary to meet wartime requirements was produced in 1945, output declined, and conditions in the industry were unfavorable because of a shortage of tools and machinery. The major part of India's production comes from the State of Bihar and is concentrated over an area of approximately 1,500 square miles. The remaining Indian production comes largely from the Nellore district of Madras and from Rajputana. A comprehensive report on the Nellore mica district has recently been released.[5] The central and provincial Governments of India have begun a program to improve mining in general and mica mining in particular. It has been suggested that a school be set up at Gundar to train miners and mine managers. It is reported also that the inquiry committee on wages of mica miners has brought out a favorable report, and wages of miners have been substantially raised.

New Zealand.—The production and processing of mica from deposits near the Paringa River in South Westland were reported in 1945. Because of the relatively inaccessible location of the deposits, which makes for high costs, it seems probable that the industry will not survive under peacetime economic conditions. The current operations are the first instance of mass production of mica in New Zealand.

Sweden.—It is reported that domestic requirements for mica in Sweden during the war period were met largely from a privately owned mine in northern Jamtland. New deposits have been opened on the eastern border of the Province of Jamtland which, when put into full production, will be able to supply the country's entire needs. Samples of mica from Sweden received in the United States during 1945 were not of strategic quality.

[5] Roy, B. C., The Nellore Mica Belt: Fort St. George Gazette, No. 7, 1945, pp. 107-136.

SALT

By Florence E. Harris and E. M. Tucker

SUMMARY OUTLINE

SUMMARY

Although total salt output in 1945 declined to 15,394,141 short tons, a drop of 2 percent from the peak of 1944, it was higher than in any other preceding year. The unit value in 1945 increased slightly from that in 1944. Evaporated salt output decreased 8 percent and salt brine declined 1 percent, but rock salt increased almost 2 percent.

The greatest decreases occurred in salt consumed in the manufacture of chlorine and soda ash. A shortage of chlorine for many industries was occasioned by lack of cylinders and tank cars. Demand persisted in excess of supply throughout 1945. Many industries were in line for salt compounds that were unobtainable. Calls for salt for meat packing and for livestock diminished perceptibly.

Most of the salt works ran at or near maximum capacity in 1945. However, two companies reported strikes, of 3 and 8 weeks' duration, respectively. Several plants that have not operated since the beginning of the war remained inactive, and at least two others joined the idle group in 1945 but sold from stock. Prices of salt were stable, but wages were reported to be higher in some sections than in 1944. Labor was so scarce in certain areas that some producers had to close their works. In other sections where labor was available, producers speeded operation by putting on additional shifts. In general, greater productivity per man was reported for the war years.

Continued shortage of supplies retarded filling orders, and many producers were behind in orders to the end of the year, the cessation of war giving no easement. Enough of a backlog of orders existed to absorb production no longer needed for war purposes. The military services continued to a certain extent to purchase salt for the armed forces, and the United States Department of Agriculture purchased table salt for its supply programs. In the latter part of 1945 the situation concerning materials for containers, both textile and paper, and difficulties in transportation were reported in certain areas as worse than during the war. Difficulty and delay in obtaining machinery and parts and making repairs, as in preceding war years, were experienced also in 1945.

Salient statistics of the salt industry in the United States, 1935–39 (average) and 1941–45

	1935–39 (average)	1941	1942	1943	1944	1945
Sold or used by producers:						
Manufactured (evaporated) short tons	2,507,374	3,330,106	3,517,832	3,993,899	3,942,621	3,630,729
In brine do	4,205,587	6,771,436	7,373,165	7,961,115	8,326,312	8,257,672
Rock salt do	1,947,254	2,619,087	2,802,287	3,259,138	3,448,238	3,505,740
Total:						
Short tons	8,660,215	12,720,629	13,693,284	15,214,152	15,717,171	15,394,141
Value [1]	$23,405,612	$33,620,376	$38,144,234	$43,878,266	$45,989,264	$46,069,064
Average per ton [1]	$2.70	$2.64	$2.79	$2.88	$2.93	$2.99
Imports for consumption:						
For curing fish short tons	[2] 21,250	7,426	[2] 6,434			
Value	[2] $43,722	$30,058	[2] $17,667			
In bags, barrels, etc. short tons	1,385	1,110	367	129	14	1,572
Value	$11,813	$12,156	$4,138	$2,425	$700	$36,343
In bulk short tons	24,131	6,896	953	1,129	5,540	2,981
Value	$55,876	$17,021	$7,496	$10,325	$31,459	$37,047
Total:						
Short tons	46,766	15,432	7,754	1,258	5,554	4,553
Value	$111,411	$59,235	$29,301	$12,750	$32,159	$73,390
Exports:						
Short tons	90,214	123,195	118,424	145,803	198,368	190,524
Value	$521,652	$807,925	$892,160	$1,173,139	$1,620,226	$1,509,301
Apparent consumption [3] short tons	8,616,767	12,612,866	13,582,614	15,069,607	15,524,357	15,208,170

[1] Values are f. o. b. mine or refinery and do not include cost of cooperage or containers.
[2] Includes salt in bags, sacks, barrels, or other packages—1942: 122 tons, $1,200.
[3] Quantity sold or used by producers plus imports minus exports.

In the middle and eastern parts of the country no substantial additions were made to plant capacity during the war. On the Pacific coast, however, considerable additional areas were put into solar-salt

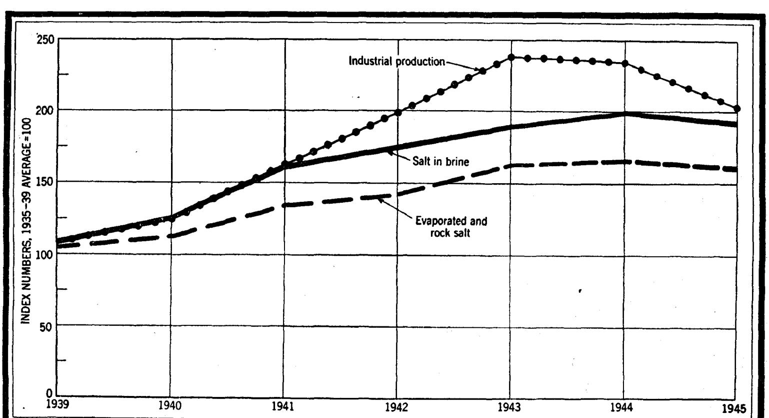

FIGURE 1.—Index of salt in brine and of evaporated and rock salt sold or used compared with industrial production, 1939-45. Index of industrial production from Federal Reserve Board.

production, resulting in an increase in output of more than 20 percent. At the same time, notable strides have been made mechanically in the handling of the product at a large operation in California, particularly as to harvesting. The equipment has been so perfected that hand harvesting has been eliminated, and all is accomplished mechanically. The end of the war had little effect on reduction of salt usage on the Pacific coast.

PRODUCTION

During 1945 salt was produced in 74 plants of 49 companies compared with 81 plants of 53 companies in 1944. Of the 1945 output 209,821 short tons of the evaporated and rock salt were iodized.

Production by States.—Thirteen States and Puerto Rico contributed to the total in 1945.

Salt sold or used by producers in the United States, 1943–45, by States

State	1943			1944			1945		
	Quantity		Value	Quantity		Value	Quantity		Value
	Short tons	Percent of total		Short tons	Percent of total		Short tons	Percent of total	
California	596,015	4	$2,839,560	712,558	5	$3,138,185	694,609	4	$3,424,711
Kansas	945,287	6	4,197,507	932,238	6	4,357,217	855,806	6	3,837,850
Louisiana	1,620,382	11	3,678,068	1,843,728	12	4,102,020	1,867,689	12	4,465,643
Michigan	4,284,685	28	14,472,820	4,287,758	27	14,921,719	4,285,493	28	14,942,443
New Mexico	10,829	(1)	21,427	23,759	(1)	105,860	9,980	(1)	20,694
New York	2,926,388	19	9,328,672	2,925,675	19	9,899,580	2,862,224	19	10,327,013
Ohio	2,818,928	19	3,824,508	2,891,395	18	4,076,481	2,764,926	18	3,997,759
Oklahoma	7,716	(1)	30,496	(2)	(2)	(2)	(2)	(2)	(2)
Puerto Rico	17,505	(1)	109,337	13,620	(1)	87,114	12,513	(1)	81,200
Texas	1,127,854	7	3,610,532	1,147,397	7	3,627,528	1,100,791	7	3,490,820
Utah	169,810	1	562,293	119,809	1	368,500	122,997	1	363,997
West Virginia	230,329	2	923,499	359,217	2	1,027,109	370,260	2	903,759
Other States [3]	458,424	3	279,547	460,017	3	277,951	446,853	3	213,175
	15,214,152	100	43,878,266	15,717,171	100	45,989,264	15,394,141	100	46,069,064

[1] Less than 0.5 percent.
[2] Included in "Other States."
[3] 1943: Nevada and Virginia; 1944–45: Nevada, Oklahoma, and Virginia.

Methods of manufacture.—No changes in the basic methods used to produce salt were noted in 1945. The output by the several methods employed is given in the accompanying table.

Salt sold or used by producers in the United States, 1944–45, by methods of manufacture

Method of manufacture	1944		1945	
	Short tons	Value	Short tons	Value
Evaporated:				
Bulk:				
Open pans or grainers	531,091	$5,452,389	944,612	$8,204,398
Vacuum pans	2,589,832	17,387,166	2,001,373	14,316,734
Solar	547,482	1,963,780	442,112	1,701,651
Pressed blocks	274,216	2,797,015	242,632	2,479,109
Rock:				
Bulk	3,369,175	11,500,601	3,410,929	12,115,237
Pressed blocks	79,063	724,456	94,811	849,154
Salt in brine (sold or used as such)	8,326,312	6,163,857	8,257,672	6,402,781
	15,717,171	45,989,264	15,394,141	46,069,064

Evaporated salt.—Continued shortage of containers made marketing difficult for evaporated salt, especially table salt. In 1945 the output of 3,630,729 short tons of evaporated salt was supplied by 52 plants in 12 States and Puerto Rico. It was produced either from the original brine of wells and ponds or from brine artificially produced from rock salt deposits. Of the 1945 output, 175,296 tons were iodized.

Evaporated salt sold or used by producers in the United States, 1944–45, by States

State	1944		1945	
	Short tons	Value	Short tons	Value
California	550,049	$2,806,964	581,730	$3,114,191
Kansas	373,112	3,085,161	337,697	2,676,919
Louisiana	58,560	462,897	65,264	548,922
Michigan [1]	1,103,825	7,868,207	879,007	7,379,970
New York	480,181	5,296,840	490,246	5,347,891
Ohio	480,469	3,562,181	451,317	3,486,752
Oklahoma	(2)	(2)	(2)	(2)
Puerto Rico	13,620	87,114	12,513	81,200
Texas	(2)	(2)	(2)	(2)
Utah	112,182	330,365	116,239	332,408
West Virginia [1]	150,286	981,980	159,129	858,155
Other States [3]	620,337	3,118,641	537,587	2,875,484
	3,942,621	27,600,350	3,630,729	26,701,892

[1] Includes a quantity of salt contained in brine for chemical use reported as evaporated salt with value as evaporated salt.
[2] Included under "Other States."
[3] 1944–45: Nevada, New Mexico, Oklahoma, and Texas.

Rock salt.—Nineteen operations produced 3,505,740 short tons in eight States. This is an all-time high record for rock salt, representing an increase of more than 1 percent over 1944. Of the quantity, 34,525 tons were iodized.

Rock salt sold by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	2,619,087	$8,761,827	1944	3,448,238	$12,225,057
1942	2,802,287	9,623,461	1945	3,505,740	12,964,391
1943	3,259,138	11,180,884			

Pressed blocks.—Eighteen evaporated-salt plants and 8 rock-salt plants supplied the output of pressed blocks. The total included 32,594 short tons of evaporated and 24,478 tons of rock salt blocks that were iodized.

Pressed-salt blocks sold by original producers of the salt in the United States, 1941–45

Year	From evaporated salt		From rock salt		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	182,331	$1,505,040	56,701	$461,265	239,032	$1,966,305
1942	240,354	2,228,062	67,490	569,014	307,844	2,797,076
1943	269,064	2,598,873	77,912	668,027	346,976	3,266,900
1944	274,216	2,797,015	79,063	724,456	353,279	3,521,471
1945	242,632	2,479,109	94,811	849,154	337,443	3,328,263

Salt content of brine.—Thirteen plants in 7 States contributed to a total of 8,257,672 short tons of salt in brine in 1945, or almost 54 percent of total salt produced.

DISTRIBUTION

In the accompanying table, salt shipped to destinations within a State in which it is produced is added to that shipped from other States. As reshipments are disregarded the statistics represent only original shipments into States by producers.

Distribution (shipments) of evaporated and rock salt in the United States, 1944–45, by States of destination, in short tons

Destination	1944		1945	
	Evaporated	Rock	Evaporated	Rock
Alabama	10, 236	87, 587	9, 787	66, 581
Arizona	14, 101	3, 864	14, 453	4, 734
Arkansas	15, 742	54, 743	8, 285	47, 730
California	342, 188	49, 249	367, 377	59, 326
Colorado	37, 388	45, 236	38, 628	32, 284
Connecticut	14, 342	11, 090	15, 772	12, 341
Delaware	4, 559	8, 745	5, 261	11, 292
District of Columbia	5, 541	2, 194	5, 932	2, 448
Florida	8, 453	31, 161	8, 822	33, 464
Georgia	19, 626	52, 390	20, 366	57, 976
Idaho	16, 948	1, 338	17, 442	1, 996
Illinois	260, 284	213, 794	228, 687	221, 495
Indiana	88, 555	67, 956	98, 072	63, 059
Iowa	122, 466	105, 542	112, 764	102, 199
Kansas	65, 272	153, 498	54, 644	130, 090
Kentucky	32, 859	104, 684	32, 961	99, 007
Louisiana	6, 028	115, 776	6, 866	130, 469
Maine	16, 276	39, 210	16, 090	43, 840
Maryland	37, 742	57, 168	41, 106	44, 568
Massachusets	54, 024	59, 824	61, 661	70, 503
Michigan	406, 373	47, 869	143, 708	65, 146
Minnesota	116, 766	71, 012	115, 982	73, 024
Mississippi	13, 723	30, 738	3, 874	32, 494
Missouri	73, 187	83, 578	79, 981	85, 839
Montana	21, 399	2, 487	22, 200	2, 870
Nebraska	64, 029	71, 591	59, 531	67, 572
Nevada	11, 894	113, 305	7, 006	51, 759
New Hampshire	4, 551	46, 696	4, 839	49, 731
New Jersey	97, 638	189, 041	99, 537	178, 354
New Mexico	9, 997	17, 465	6, 809	22, 229
New York	220, 224	470, 426	239, 407	524, 577
North Carolina	57, 839	46, 523	58, 401	47, 110
North Dakota	[1] 10, 929	5, 044	11, 782	5, 225
Ohio	[1] 206, 855	116, 115	204, 954	144, 880
Oklahoma	32, 236	39, 347	29, 659	36, 019
Oregon	37, 898	192	42, 989	298
Pennsylvania	147, 566	116, 637	155, 320	131, 908
Rhode Island	9, 530	9, 717	9, 642	12, 307
South Carolina	9, 739	18, 081	11, 786	20, 648
South Dakota	22, 057	19, 617	24, 177	18, 472
Tennessee	31, 401	50, 778	24, 642	63, 659
Texas	566, 273	243, 388	515, 030	250, 170
Utah	26, 234	3, 410	27, 890	2, 405
Vermont	5, 608	11, 838	5, 281	13, 253
Virginia	55, 606	84, 973	55, 830	83, 931
Washington	154, 960	678	137, 618	1, 569
West Virginia	165, 132	80, 776	172, 647	75, 883
Wisconsin	109, 922	29, 241	123, 200	34, 304
Wyoming	14, 784	2, 762	9, 757	3, 589
Other [2]	65, 641	159, 864	62, 274	171, 113
	3, 942, 621	3, 448, 238	3, 630, 729	3, 505, 740

[1] Revised figure.
[2] Includes salt used in Puerto Rico (evaporated salt); exports to Africa, Canada, Central America, Cuba, Mexico, Newfoundland, South America, West Indies, and other countries; shipments to Alaska, Hawaii, and Puerto Rico; and some shipments to unspecified destinations.

Salt shipped to noncontiguous Territories of the United States, 1944-45 [1]

Territory	1944		1945	
	Short tons	Value	Short tons	Value
Alaska	3,211	$75,157	[2] 3,952	$92,292
American Samoa	9	431	9	459
Hawaii	2,572	76,675	4,830	143,933
Puerto Rico	2,806	98,654	8,959	293,594
Virgin Islands	90	4,073	95	5,408

[1] Figures compiled by M. B. Price, Bureau of Mines, from records of the U. S. Department of Commerce.
[2] Shipping weight; not strictly comparable to earlier years.

CHANGES IN THE INDUSTRY

California.—Leslie Salt Co., San Francisco, which operated a rock-salt deposit at Fallon, Nev., during the war, has reported the permanent shut-down of the operation. Imperial Salt Co. had no salt crop in 1945 but expects to produce in 1946. Long Beach Salt Co. reports all production at its Los Angeles County plant stopped November 30, 1945. The Monterey Bay Salt Works was destroyed by fire October 10, 1945. The company is rebuilding the plant.

Kansas.—On June 29, 1945, the entire refining plant and evaporated-salt packaging plant of the American Salt Corp., Lyons, was destroyed by fire. Since then most of the production of this company has been rock salt. A new plant is being built which probably will be completed by midsummer 1946.

Michigan.—The Marysville plant of the Morton Salt Co. was inactive part of 1945, owing to a fire that destroyed the packing and shipping department in 1944.

New Mexico.—Curtis Salt Co., Catron County, reports that its supply of salt is about exhausted.

Ohio.—Pomeroy Salt Corp., Minersville, did not produce in 1945 owing to war conditions but expects to resume operation early in 1946. The Colonial Salt Co., Akron, was bought by the General Foods Corp. on August 15, 1945, and operation was continued by the purchaser.

Oklahoma.—Ezra S. Blackmon Salt Co., Freedom, produced no salt in 1945. The operation was bought in 1944 and the plant was being dismantled and sold in 1945.

Puerto Rico.—Sobrinos de Gonzales & Co., operation was inactive in 1945 but the shut-down is temporary.

West Virginia.—The Ohio River Corp., Mason, did not produce in 1945.

RESOURCES

According to the Mississippi Geological Survey, the Mississippi Oil and Gas Engineering Committee report for January 1946 lists 27 salt domes recently discovered in 16 counties of the southern half of the State. In many places the salt is associated with anhydrite. The cap rock ranges in depth from 290 to 7,817 feet.

In 1945, a map [1] including text was published, furnishing new information on the extent and thickness of the salt beds of Salina age of Michigan and Ontario.

Other resources and plants were described during the year.[2] It is significant that wherever rock salt is developed by drilling, that locality becomes a potential site for a chemical industry—chlorine, electrolytic caustic soda, and other sodium chemicals.

USES

Previous Yearbook chapters on salt have elucidated the war uses of salt and salt compounds, many of which survived for civilian use. DDT, now being produced by more than 10 companies, is being used not only in homes and camps but is being sprayed from airplanes over fields and forests for insect control. Moreover, the material is incorporated in paints and wall washes and is used as a sheep dip.

The quantity of salt consumed in making synthetic rubber rose to 200,000 short tons in 1945 from 140,000 tons in 1944 and 66,000 tons in 1943. This is exclusive of that used in making chlorine therefor and in rubberlike materials.

Salt sold or used by producers in the United States, 1944–45, by classes and uses, in short tons

Use	1944			1945		
	Evaporated	Rock	Brine	Evaporated	Rock	Brine
Chlorine, bleaches, chlorates, etc.	1,141,408	806,010	917,931	795,859	644,916	1,092,200
Soda ash	----------	104	7,339,998	(1)	----------	7,087,227
Dyes and organic chemicals	67,116	46,114	----------	58,101	41,460	----------
Soap (precipitant)	54,218	22,402	----------	50,141	18,862	(1)
Other chemicals	98,260	414,233	(1)	105,363	441,579	(1)
Textile processing	40,171	81,247	----------	35,968	101,378	----------
Hides and leather	97,506	147,819	----------	105,227	161,049	----------
Meat packing	426,271	373,816	----------	362,202	360,744	----------
Fish curing	35,998	67,844	----------	36,123	71,571	----------
Butter, cheese, and other dairy products	105,174	9,503	----------	112,087	5,592	----------
Canning and preserving	146,182	13,210	----------	156,713	16,164	----------
Other food processing	206,150	17,424	----------	230,993	22,243	----------
Refrigeration	39,575	196,353	----------	45,449	235,904	----------
Livestock	550,975	213,999	----------	539,929	192,817	----------
Highways, railroads, dust, and ice control	9,300	218,903	----------	10,149	307,656	----------
Table and other household	436,323	166,292	----------	472,106	210,175	----------
Water treatment	165,024	184,427	(1)	179,544	196,842	(1)
Agriculture	53,622	11,156	----------	42,753	14,013	----------
Metallurgy	35,741	30,375	----------	28,922	29,000	(1)
Other uses [2]	233,607	427,007	68,383	263,100	433,775	78,245
	3,942,621	3,448,238	8,326,312	3,630,729	3,505,740	8,257,672

[1] Included under "Other uses."
[2] Includes also exports where use is not specified.

[1] Landes, Kenneth K., The Salina and Bass Island Rocks in the Michigan Basin: Geol. Survey, U. S. Dept. of Interior, prepared with the cooperation of the Geological Survey Division, Michigan Dept. of Conservation, and the Department of Geology, University of Michigan; Preliminary Map No. 40, 1945.

[2] Harrington, E. R., New Mexico's Crater Lake: Compressed Air Mag., vol. 50, No. 7, July 1945, pp. 188–189. Mining World, Bonneville Potash: August 1945, pp. 28–31. Tustin, E. B., Jr., Salt Our Most Useful Mineral: Compressed Air Mag., vol. 50, No. 11, November 1945, pp. 291-294.

IMPORTS AND EXPORTS[3]

Both imports and exports of salt declined in 1945. Such transactions are relatively small compared with domestic trade. It is notable that fish salt imports were lacking again in 1945.

Salt imported for consumption in the United States, 1941–45, by classes

Year	In bags, sacks, barrels, or other packages (dutiable)[1]		Bulk			
			Dutiable		Free (used in curing fish)	
	Short tons	Value	Short tons	Value	Short tons	Value
1941	1,110	$12,156	6,896	$17,021	7,426	$30,058
1942	367	4,138	953	7,496	[2] 6,434	[2] 17,667
1943	129	2,425	1,129	10,325		
1944	14	700	[3] 5,540	[3] 31,459		
1945	1,572	36,343	2,981	37,047		

[1] Includes 98 pounds valued at $3 imported free in 1942, 12,939 pounds valued at $493 in 1943, 9,001 pounds valued at $356 in 1944, and 1,500 pounds valued at $40 in 1945.
[2] Includes salt in bags, barrels, or other packages as follows: 1942: 122 tons, $1,200; 1941, 1943, 1944, and 1945: None reported.
[3] Includes 3,818,644 pounds valued at $9,244 imported free.

Salt imported for consumption in the United States, 1944–45, by countries

Country	1944		1945	
	Short tons	Value	Short tons	Value
North America:				
Canada	1,319	$20,445	1,839	$21,913
Curaçao (N. W. I.)			847	18,918
Dominican Republic			1,212	28,200
West Indies:				
Bahamas	97	298		
Jamaica			522	3,345
Leeward and Windward Islands			133	1,014
Asia: Arabia Peninsula States	958	1,916		
Africa: Egypt	3,180	9,500		
	5,554	32,159	4,553	73,390

Several countries, including the Philippines and Yugoslavia, reappeared in the table of exports of salt from the United States in 1945.

[3] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

Salt exported from the United States, 1944–45, by countries

Country	1944		1945	
	Short tons	Value	Short tons	Value
North America:				
Bermuda	82	$3,305	30	$1,427
Canada	123,828	669,676	149,658	865,947
Central America:				
British Honduras	568	7,530	428	5,616
Costa Rica	19	805	109	1,994
Guatemala	17	580	10	450
Honduras	228	4,296	210	3,905
Nicaragua	678	14,383	196	3,556
Panama:				
Canal Zone			530	18,142
Republic of	71	1,725	60	1,732
Greenland	3,660	33,753	2,477	22,655
Iceland	10	563	2	125
Mexico	13,017	220,696	7,628	152,861
Newfoundland and Labrador	40,336	256,915	7,748	56,271
West Indies:				
British:				
Barbados	414	7,902	6	215
Jamaica	1,801	50,391	311	4,109
Trinidad and Tobago	104	1,807	74	1,884
Other British	50	2,229	50	1,761
Cuba	6,140	84,518	5,967	81,226
Curaçao (N. W. I.)	312	12,121	235	7,448
Dominican Republic	229	9,177	19	902
Haiti	18	1,089	18	1,057
Other North America	5	265	150	2,789
South America:				
Brazil	2,691	91,895	3,738	117,772
British Guiana	396	8,046	2	47
Colombia	1	400	1	135
Surinam	370	9,421	275	5,657
Venezuela	6	329	147	5,885
Other South America	62	2,001	9	888
Europe:				
Belgium and Luxembourg			8,482	81,324
U. S. S. R.	325	24,800	(1)	6
Yugoslavia			61	2,408
Other Europe	(1)	1	23	8,863
Asia:				
India and Dependencies	7	394	2	130
Philippine Islands			243	9,266
State of Bahrein	14	484	305	5,258
Other Asia	13	1,208	24	1,452
Africa:				
Algeria	(1)	14	4	266
Liberia	2,151	66,619	540	14,757
Union of South Africa	484	23,046	442	10,780
Other Africa	75	3,403	10	911
Oceania:				
British:				
Australia	1	51		
New Zealand	2	56	4	64
Other British	1	20		
French	182	4,312	296	7,358
Japanese Mandated Islands			(1)	2
	198,368	1,620,226	190,524	1,509,301

[1] Less than 1 ton.

WORLD PRODUCTION

Total world production of salt in 1944 is estimated at more than 33,000,000 metric tons, of which the United States produced about 43 percent. Because salt is the basic raw material of the important alkali chemicals, the world distribution of supplies has significant implications. If the United States had not possessed a virtually inexhaustible salt supply as well as a great chemical industry during the last half decade our country would have been seriously handicapped during the war. Moreover, it was Germany's large salt resources and well-developed chemical industry that enabled it to obtain substantial foreign credits through export of large quantities of salt and sodium compounds derived therefrom.

Unlike the United States, in a majority of foreign countries the salt industry is a government monopoly and is rigidly controlled. During World War II, a number of countries had to ration salt, the supply was so short. Many gift packages sent abroad from the United States contained small supplies of salt.

Significant facts and figures for as many foreign salt-producing countries as are obtainable at present are given herein by main geographic divisions. The tons are metric unless otherwise stated.

NORTH AMERICA

Salt is produced in *Canada* by 9 companies; all is recovered from brine except in Nova Scotia, where it is mined from rock-salt deposits. A new process to beneficiate the mined salt has been tried out in a 25-ton per day pilot plant, operation difficulties have been overcome, and a first-class product is being obtained. Salt resources of the Amherst, N. S., area, proved by diamond-drilling to be extensive, are being developed by the Maritime Industries Ltd. (subsidiary of Standard Chemical Co. Ltd.), at Nappan, for the manufacture of evaporated salt and chemicals, also to provide salt heretofore imported suitable for curing fish. *Newfoundland*, in the spring of 1945, approved in principle a long-term investigation of salt potentialities in the Codroy area and made provision for the purchase of a diamond drill. Nothing was done on the salt survey in 1945, awaiting arrival of the equipment. It is felt that inasmuch as Newfoundland annually imports 50,000 tons of salt it would be advantageous to obtain it locally. The *West Indies* include several islands that produce solar salt from sea water. Except for *Cuba* and *Turks and Caicos Islands* the annual output does not reach 50,000 tons. Cuba has 20 salt works that supply 80 percent of domestic requirements, and the remainder is supplied by imports, chiefly from the United States.

SOUTH AMERICA

Large sources of salt having been found in accessible parts of *Brazil*, plants have been established for making alkali chemicals, and expansion of the industry is forecast. Several years ago a Salt Institute was created to equalize the rights of small producers competing with larger ones. *Chile* produces enough salt to satisfy domestic needs. The greatest single use of salt is in metallurgy, although the country has been endeavoring to develop a chemical industry. *Colombia's* salt output—derived from rock-salt mines, saline springs, and marine salinas—is devoted to local use; exports are negligible. Production in *Ecuador* is large enough to provide an exportable surplus. Both output and sale are under strict control of a Government agency known as "Estanco." About 57 percent of the salt produced in *Peru* is from sea water by solar evaporation, 23 percent from rock-salt deposits, and 20 percent from saline springs. In *Venezuela* the most important source of salt is the Peninsula of Araya, State of Sucre. The small island of Coche nearby at times has produced salt but Araya can supply more than the country's requirements. In mid-1942 new salt works were under construction.

EUROPE

Germany, from 1939 to 1944, had an average output of 3,633,000 tons of rock salt and 604,000 tons of refined salt. Formerly first among world exporters of salt, Germany exported only 734,000 tons in 1940. The industry in war years is well-described in two Bureau of Mines reports.[4] Many of Germany's salt mines were used during the war as storage places of valuables of gold and art treasures, which curtailed salt-production facilities; and by the war's end common salt was being produced from the Wintershall potash mine at Herringen, Hessen Province, where it had not been produced heretofore. The principal salt operations in the United States Zone total 10; in the British, 28; in the Russian, 23; and in the French Zone 6. Production of salt in *Italy* and colonies in the 1932–41 decade ranged from almost 1 million to 1½ million tons a year. Of this salt more than half was sea salt, most of the remainder was rock salt, and a relatively small tonnage was recovered from springs. Figures for the war years 1942–44 are not yet available; those for rock salt for the greater part of 1945 indicate a probable output of about 32,000 tons of that type. In 1940 aggregate salt exports placed the Italian Empire, including the African colonies, third on the list of world exporters, with the colonies exporting far more than Italy proper with its 156,000 tons. The *Netherlands* salt sources have been worked for many years and increasingly since 1930. By 1934 the annual output was 75,000 tons and since 1939 has averaged 200,000 tons. It is recovered entirely from wells in the eastern part of the country near the German border. The wells were undamaged by war. Availability of salt resulted in the establishment of a modern alkali industry which has grown in recent years. Improvements in salt refining are contemplated and up-to-date technology is being studied. *Rumania* is an important salt-producing country. Reliable, up-to-date figures are lacking; but in 1938, the Government monopoly's 9 mines (mostly mechanized) produced a total of 370,000 tons, of which 290,000 tons were edible and 80,000 industrial salt. Exports totaled 79,000 tons; 21,000 tons of block, ground, and industrial salt were shipped to Hungary, and 58,000 tons of block were shipped to Bulgaria and Yugoslavia. Salt is found in many places in *Spain* and normally about 20 Provinces contribute to the total production. In the first 3 years (pre-Civil War) of the decade 1933–42, salt output averaged 870,000 tons.

[4] Bureau of Mines, Mineral Trade Notes: Vol. 21, No. 2, August 1945, p. 38; vol. 22, No. 3, March 1946, p. 36.

During the Civil War, production was at the rate of about 365,000 tons. In the period 1940–42, the average was 625,000 tons. In 1943, 29 mines produced 266,226 tons of rock salt and 113 plants produced 500,392 tons of evaporated salt. The rock salt was produced chiefly in Santander Province. Alicante Province (8 plants) led in output of evaporated salt, followed by the Province of Cadiz (35 plants) 119,394 tons, and Murcia (4 plants) 76,214 tons. The remainder was supplied by 66 smaller plants in 10 other Provinces. For a time Spain was second in the list of world exporters of salt. The salt industry in *U. S. S. R.* was reported to be making a generally quick recovery. According to the press,[5] geologists resumed prospecting the Davidovsky salt deposits begun before the war. The salt mine at Artemovsk, Donets Basin, said to be the largest in U. S. S. R., has been dewatered. It is being mechanized and will have an output capacity of 1,500,000 tons a year.

ASIA

The *Ceylon* Government derives about $US900,000 annually from its salt monopoly. Exports of salt without Government license are prohibited; imports are negligible. Annual production (solar salt) normally averages about 500,000 cwt. (of 112 pounds) chiefly from Hambantota in the south and Puttalam in northwest Ceylon. Some salt also comes from the Jaffna and Trincomalee districts. In 1945 the retail price per hundredweight, including Government tax, remained at $1.39. That marketed direct to the consumer at the saltern was sold at $1.07, in carlots delivered to any rail point on the island, the consumer supplying the containers. Salt in containers supplied by the Salt Department was marketed through nine retail stores. During World War II, *China* was deprived of its vast coastal supplies of salt and had to depend upon the interior fields, the most important of which are in Szechwan [6] and the Northwest Provinces of Kansu, Tsinghai, and Ningsia. Free China's nationwide salt monopoly, as established in January 1942, functions under the Ministry of Finance and is administered by the Directorate General of Salt Administration in Chungking. It aims at increasing the nation's revenue and stabilizing the price of an important daily necessity. It operates on the basis of: Production by the people; purchase and transportation by the Government; and distribution and sale by Government-supervised commercial firms. The methods of production and the quality of the product are being improved. The Northwest District Salt Administration functions through the agency of 78 offices in the three Provinces mentioned. The salt lakes of the District are divided into two categories—Mongolian and earth-salt lakes; the first-named supplied 52 percent of the total in 1943. During the war, it was difficult for producers in Free China to obtain iron kettles and pans for making salt, and it was necessary to utilize bamboo extensively for such items as twine, rope, piping, containers, and other supplies. *India* for many years has produced more than 1½ million tons of salt annually and output in 1942 and 1943 was nearly two million, the greater part of which was solar salt. The increase during the war is

[5] Chemical and Engineering News, vol. 23, No. 15, Aug. 10, 1945, p. 1374.
[6] Chong, T. Y., Modernization of Salt Mining in Szechwan: Mining Jour. (London), vol. 225, No. 5735, July 21, 1945, pp. 466–467.

attributed to efforts to offset quantities formerly imported from Middle East countries and to the 100-percent increase in chemical production in the period.[7] *Japan* has small resources of salt on its home islands; sea water is the sole source. The country has depended upon supplies from Formosa (Taiwan), Manchuria, Kwantung (Leased Territory), China, and China's coastal areas, and, in the past, upon imports from Aden, African Colonies, Ceylon, and at times from Turkey. During the war it attempted to develop the industry at Singkwang, on the west coast of Borneo, to insure self-sufficiency of the island during occupancy. Japan utilized salt not only for its domestic production of heavy chemicals but also in chemical establishments in the territories of the Japanese Empire. As early as 1936 Japan had planned a program for developing its territorial salt fields and an augmented salt production to supply its rapidly expanding alkali industry. Late in 1939, the Japanese organized the North China Salt Co., a subsidiary of their monopolistic North China Development Co., primarily to expand Changlu production and promote salt exports to Japan. On November 24, 1945, General MacArthur granted the Japanese Government permission to import salt; the quantities to depend upon availability of shipping as well as Japan's ability to pay in commensurate exports. The important salt operations in *Korea* (*Chosen*) are the Ch'ongch'on, in North and South Heian Province, Chuan, Keiki Province, and Kwangnyang-man in South Heian.[8] Production of salt in *Turkey* has increased noticeably in the last few years. The total in 1945 consisted of 181,482 tons of sea salt, 40,463 tons of salt from wells, 33,358 tons of lake salt, and 16,193 tons of rock salt. At the end of 1945 it was planned to improve the salt fields at Camalti near Izmir, where a new plant for making salt compounds will be built.

AFRICA

Most of the salt produced in northern and upper eastern African coastal countries is from sea water, although several produce some rock salt also. Both sources normally supply large tonnages but during the war output was reduced considerably. The brine of the Mediterranean, the Red Sea, and other sea waters thereabout are reported to be more saline than the Atlantic Ocean because the rate of evaporation of the water is more rapid and few fresh-water streams empty into the more confined sea waters to dilute the brine. *Egypt*, the most important salt-producing country in this continent, obtains salt by solar evaporation at Alexandria and Port Said. A concessionaire operates at each place under Egyptian Government control. Normally the combined production of the two operations met all local needs (65,000 tons annually) and provided a large exportable surplus of about 280,000 tons.[9] In 1943 prices of salt for ballast ranged from 8 to 13 shillings ($US1.61 to $2.61) per ton compared with $1.21 in 1942. The prices of salt sold for commercial uses are calculated according to the markets where sold and therefore differ greatly. In Egypt salt usually sells for about $7.45 per ton in bulk. Egyptian Sudan annual output averaged 40,000 tons in 1941–43.

[7] Mining Journal (London), India's Chemical Industry: Vol. 225, No. 5738, Aug. 11, 1945, p. 519.
[8] Bureau of Mines, Mineral Resources of Japan: Foreign Minerals Survey, vol. 2, No. 5, October 1945, pp. 110, 111.
[9] Bureau of Mines, Mineral Trade Notes: Vol. 22, No. 1, January 1946, p. 53.

World production of salt, 1938–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
North America:								
Canada	398,013	385,550	420,974	510,930	591,343	619,528	632,841	615,072
Costa Rica	4,740	6,822	6,800	6,000	7,727	3,414	6,197	6,033
Guatemala	10,465	(2)	(2)	(2)	11,600	12,440	12,466	(2)
Honduras	(2)	(2)	(2)	(2)	3,400	2,500	2,700	1,000
Mexico	107,701	(2)	(2)	(2)	584,000	744,000	(2)	(2)
Nicaragua	(2)	(2)	(2)	(2)	[3] 6,000	[3] 6,000	(2)	[3] 6,000
Panama	3,332	4,536	5,199	(2)	9,526	----------	[3] 10,000	2,437
United States:								
Rock salt	1,725,330	1,846,254	2,055,260	2,375,983	2,542,179	2,956,625	3,128,173	3,180,337
Other salt	5,555,486	6,570,481	7,343,089	9,163,917	9,880,094	10,845,349	11,130,131	10,784,920
West Indies:								
British:								
Bahamas	17,900	11,600	27,000	25,400	6,170	790	60,960	38,800
Turks and Caicos Islands [4]	35,578	47,389	67,028	48,179	15,581	8,512	33,779	21,228
Cuba	57,970	113,398	113,398	41,909	43,545	18,416	15,422	(2)
Dominican Republic	9,286	9,536	7,500	14,700	5,590	12,620	11,300	15,100
Haiti [3]	6,000	12,600	10,500	2,100	(2)	8,000	8,000	8,000
Netherlands [4]	2,013	247	37	3,226	4,574	4,792	5,150	3,109
South America:								
Argentina:								
Rock salt	----------	700	350	860	355	(2)	(2)	(2)
Other salt	264,150	303,321	292,307	372,689	364,279	(2)	(2)	(2)
Brazil	780,144	564,330	398,538	550,000	598,537	416,121	453,601	(2)
Chile	27,772	39,593	44,317	57,185	55,578	37,111	46,397	(2)
Colombia:								
Rock salt	4,010	3,950	4,703	4,530	4,816	11,790	(2)	(2)
Other salt [3]	84,000	101,400	105,100	79,400	103,926	108,000	(2)	(2)
Ecuador:								
Rock salt	----------	----------	(2)	----------	(2)	(2)	(2)	(2)
Other salt	13,800	16,145	29,900	20,207	24,893	11,947	35,958	(2)
Peru	38,451	39,669	41,326	46,855	45,838	49,027	53,818	[3] 60,000
Venezuela	22,658	20,473	52,540	40,193	17,837	33,838	[3] 25,000	(2)
Europe:								
Bulgaria:								
Rock salt	10,242	13,168	15,000	(2)	(2)	(2)	(2)	(2)
Other salt	66,258	(2)	65,000	(2)	(2)	(2)	(2)	(2)
Czechoslovakia	174,000	(2)	[5] 5,800	[5] 10,000	(2)	(2)	(2)	[5] 5,000
France:								
Rock salt and salt from springs	1,560,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other salt	548,000	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Germany:								
Rock salt	2,694,984	3,094,127	3,397,962	3,662,968	4,126,534	[3] 4,000,000	[3] 3,520,000	(2)
Other salt	585,326	625,060	690,715	665,456	569,393	[3] 550,000	[3] 500,000	(2)
Austria:								
Rock salt	786	1,476	1,017	536	421	(2)	(2)	(2)
Other salt	93,576	107,809	108,533	106,815	104,280	(2)	(2)	(2)
Greece	102,057	82,425	(2)	(2)	(2)	(2)	(2)	(2)
Italy:								
Rock salt	613,870	682,589	685,295	720,510	(2)	(2)	(2)	[3] 32,000
Other salt	885,205	682,519	735,864	756,134	(2)	(2)	(2)	(2)
Malta	1,523	1,753	(2)	(2)	(2)	(2)	(2)	(2)
Netherlands	164,266	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Poland	642,875	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Portugal:								
Rock salt	----------	----------	----------	----------	(2)	73	(2)	(2)
Other salt	[4] 6,096	[4] 9,289	[4] 11,955	[4] 6,981	[4] 747	669	(2)	(2)
Rumania:								
Rock salt	350,618	(2)	(2)	(2)	280,038	363,151	(2)	(2)
Other salt	1,140							
Spain:								
Rock salt	150,878	157,784	206,650	195,686	248,302	266,226	243,076	(2)
Other salt	102,671	661,269	463,795	358,217	405,665	500,392	449,058	(2)
Switzerland	84,049	90,000	77,000	67,000	71,000	74,000	72,000	81,113
United Kingdom:								
Great Britain:								
Rock salt	19,974	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other salt	2,651,939	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Ireland, Northern:								
Rock salt	2,362	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Other salt	5,757	10,740	13,948	13,607	13,499	11,183	11,220	(2)
Yugoslavia	52,634	54,213	(2)	(2)	[6] 28,000	(2)	(2)	(2)

See footnotes at end of table.

World production of salt, 1938–45, by countries, in metric tons [1]—Continued

Country [1]	1938	1939	1940	1941	1942	1943	1944	1945
Asia:								
Aden	282,510	294,077	258,714	181,873	70,107	202,434	208,603	142,191
Burma	39,319	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Ceylon	36,490	37,556	29,973	23,271	19,572	13,761	[3] 26,570	36,858
China (including Manchuria)	[3] 3,000,000	[3] 3,000,000	[3] 3,000,000	[7] 1,152,000	[8] 800,000	(2)	(2)	(2)
Cyprus	3,000	3,000	3,000	(2)	(2)	(2)	(2)	(2)
India:								
British:								
Rock salt	191,395	196,503	207,294	195,890	219,481	332,843	332,843	(2)
Other salt	1,372,979	1,326,544	1,464,648	1,611,640	1,702,845	1,624,977	1,624,977	(2)
Portuguese	29,527	27,979	38,564	[4] 10,070	[4] 13,672	[4] 10,290	19,144	[4] 9,146
Indochina	193,050	213,526	166,000	(2)	(2)	(2)	(2)	(2)
Iraq	7,907	9,107	8,331	10,303	11,604	21,356	11,792	(2)
Korea (Chosen)	332,742	(2)	(2)	(2)	(2)	[3] 350,000	(2)	(2)
Netherlands Indies	90,909	[9] 141,208	[9] 388,837	(2)	(2)	(2)	(2)	(2)
Palestine:								
Rock salt	444	645	599	576	1,886	1,822	1,181	(2)
Other salt	8,065	8,736	9,944	10,965	10,705	17,955	19,055	(2)
Syria [3]	10,000	10,000	10,000	20,000	20,000	20,000	(2)	12,000
Thailand (exports)	156,268	95,170	112,197	(2)	(2)	(2)	(2)	(2)
Turkey:								
Rock salt	18,485	(2)	19,621	22,350	22,105	22,976	266,330	16,193
Other salt	228,808	(2)	193,213	173,898	202,861	243,353		255,303
Africa:								
Algeria	74,630	(2)	(2)	68,376	68,376	25,488	46,568	(2)
Belgian Congo	1,013	(2)	1,038	1,159	1,191	(2)	1,711	(2)
Canary Islands [3]	2,000	2,000	2,000	(2)	(2)	(2)	(2)	(2)
Egypt (exports)	284,949	442,532	206,211	155,123	100,716	106,901	199,116	255,107
Eritrea	61,736	77,269	50,116	2,689	4,419	8,101	10,721	(2)
Ethiopia: Rock salt [3]	10,000	10,000	10,000	10,000	10,000	10,000	(2)	(2)
French West Africa [3]	(2)	(2)	(2)	(2)	40,000	48,000	53,000	(2)
Kenya Colony	3,250	5,318	9,425	14,177	13,694	15,318	14,054	15,491
Libya (Italian Africa):								
Cyrenaica [3]	10,000	10,000	10,000	(2)	(2)	(2)	(2)	(2)
Tripolitania [3]	20,000	20,000	20,000	(2)	(2)	(2)	(2)	(2)
Mauritius [3]	1,500	1,500	1,500	(2)	(2)	(2)	(2)	(2)
Morocco, French:								
Rock salt	909	1,400	1,546	6,587	10,934	12,208	8,774	(2)
Other salt	(2)	13,400	23,605	27,150	32,988	31,963	19,000	(2)
Nigeria [3]	400	400	400	(2)	(2)	(2)	(2)	(2)
Portuguese East Africa	6,448	6,628	251	7,505	2,562	379	221	(2)
Portuguese West Africa (Angola)	[3] 25,000	22,970	29,148	40,305	45,145	43,419	37,652	(2)
Somaliland:								
British	353	629	-----	-----	(2)	(2)	(2)	(2)
French	51,622	78,116	18,499	3,310	200	22,244	42,657	[3] 55,000
Italian	186,000	146,000	(2)	(2)	(2)	(2)	(2)	(2)
South-West Africa:								
Rock salt	641	751	1,125	1,654	2,090	2,096	2,870	3,510
Other salt	4,431	4,704	5,364	7,811	8,314	8,616	9,049	10,022
Sudan, Anglo-Egyptian	37,532	40,633	40,471	40,668	39,630	40,488	35,969	(2)
Tanganyika Territory	10,167	9,997	8,817	8,318	8,973	11,542	11,214	[4] 2,687
Tunisia	129,287	106,310	122,267	107,667	(2)	10,053	52,478	(2)
Uganda	3,169	2,626	3,374	4,314	4,212	5,243	(2)	(2)
Union of South Africa	117,717	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Oceania:								
Australia:								
South Australia	76,013	80,759	146,991	173,431	176,972	187,270	167,531	(2)
Western Australia	3,850	(2)	(2)	(2)	(2)	(2)	(2)	(2)

[1] In addition to the countries listed salt is produced in Albania, Bolivia, Formosa (Taiwan), Gold Coast, Japan, Leeward Islands, Madagascar, Philippine Islands, Southern Rhodesia, U. S. S. R., and Victoria (Australia), but figures of production are not available.
[2] Data not available.
[3] Estimate.
[4] Exports.
[5] Estimated production of only remaining mine, which is in Solnohrad near Presov, Slovakia; portion located in Sub-Carpathia, Ukraine, is now ceded to U. S. S. R.
[6] January to June, inclusive (Croatia only).
[7] Unoccupied China.
[8] January to September, inclusive.
[9] Incomplete data.

MAGNESIUM COMPOUNDS AND MISCELLANEOUS SALINES

By CHARLES L. HARNESS AND F. M. BARSIGIAN[1]

SUMMARY OUTLINE

SUMMARY

The down-trend in basic refractory requirements continued in 1945, but most of the decrease in mine output of magnesite was caused by suspension of operation of the greatest individual producer in the history of the industry, Basic Magnesium, Inc., Gabbs, Nev. The plant was shut down in late 1944. Output of most of the natural salines, such as sodium sulfate and carbonate, magnesium sulfate, and calcium chloride, showed increases. Iodine was produced in somewhat greater volume than in 1944. The borates industry, with the aid of recently built capacity, showed the best year since 1937.

Part I.—MAGNESIUM COMPOUNDS

MAGNESITE

Mine production of crude magnesite in 1945 was 336,458 short tons, the lowest since 1940, but still high compared with prewar figures—the 3 year average of 1937–39, for example, having been 166,000 short tons. The main reason for the decline was the closing in 1944 of the giant Basic Magnesium, Inc., flotation plant at Gabbs, Nev. The sharp drop in production of caustic-calcined magnesia from a peak of 191,792 short tons in 1943 to 43,270 tons in 1945 was similarly caused by the Basic Magnesium, Inc., shut-down. The dwindling war requirements for steel in 1945 eased the demand for refractory magnesias, accounting for the 8-percent drop in this category.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the Department of Commerce.

Salient statistics of the magnesite industry in the United States, 1941–45

	1941	1942	1943	1944	1945
Crude:					
Mined: [1]					
Short tons	374,799	497,368	754,832	561,450	336,458
Value	$2,655,547	$3,874,334	$6,071,596	$4,407,461	$2,324,957
Sold by producers:					
Short tons	4,536	6,835	4,090	(2)	(2)
Value	$54,045	$57,350	$47,788	(2)	(2)
Average per ton [3]	$11.91	$8.39	$11.68	(2)	(2)
Imports for consumption:					
Short tons				1,039	
Value				$34,588	
Caustic-calcined magnesia:					
Sold or used by producers: [4]					
Short tons	30,225	41,889	191,792	139,243	43,270
Value	$1,052,077	$2,028,126	$11,497,505	$6,481,963	$2,503,544
Average per ton [3]	$34.81	$48.42	$59.95	$46.55	$57.86
Imports for consumption:					
Short tons	864	578	290	559	445
Value	$23,972	$19,105	$13,122	$15,286	$12,134
Refractory magnesia:					
Sold or used by producers: [5]					
Short tons	201,481	273,661	301,382	278,490	254,994
Value	$5,052,879	$7,823,963	$9,341,183	$8,426,049	$7,414,218
Average per ton [3]	$25.08	$28.59	$30.99	$30.26	$29.08
Imports for consumption:					
Short tons	36,791	7,728	9,233	6,176	5,506
Value	$824,068	$280,342	$310,497	$260,062	$234,519

[1] Partly estimated; most of the crude is processed by the mining companies, and very little enters open market.
[2] Bureau of Mines not at liberty to publish figures.
[3] Average receipts f. o. b. mine shipping point.
[4] 1941: Includes caustic-calcined magnesite and caustic-calcined magnesia from sea-water bitterns; 1942–45: Includes caustic-calcined magnesite and reactive magnesia from sea-water bitterns, well brines, and raw sea water and from precipitated magnesium carbonate obtained from dolomite.
[5] 1941: Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, and sea-water bitterns; 1942–43 and 1945: Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, sea-water bitterns, well brines, and raw sea water; 1944: Includes dead-burned magnesite and refractory magnesia from brucite, dolomite, sea-water bitterns, and raw sea water.

Magnesia sold or used by producers in the United States, 1943–1944, by kinds and sources

[Quantities and values reported apply to finished products, not raw materials]

Finished product	From magnesite		From brucite, dolomite, and sea-water bitterns		From well brines and raw sea water	
	Short tons	Value	Short tons	Value	Short tons	Value
1943						
Caustic-calcined	137,300	$7,941,587	8,649	$547,888	45,843	$3,008,030
Refractory	185,992	4,426,152	89,283	3,664,258	26,107	1,250,773
	323,292	12,367,739	97,932	4,212,146	71,950	4,258,803
1944						
Caustic-calcined	97,933	4,033,759	11,129	759,288	30,181	1,688,916
Refractory	152,802	3,217,714	87,539	3,537,561	38,149	1,670,774
	250,735	7,251,473	98,668	4,296,849	68,330	3,359,690

In 1945, further inroads were made on the conventional magnesite-slag open-hearth bottom by rammed bottoms and plastic chrome sub-hearths, and it appears that the trend may be accentuated even more in the future. A canvass of basic steel plants in 1945 by the Open Hearths Committee, Irons and Steel Division, American Institute of Mining and Metallurgical Engineers,[2] showed that 386 of the 610

[2] Debenham, W. S., Analysis of Questionnaire on Open-Hearth Bottom Construction and Materials: Proc., Open-Hearth Conference, Am. Inst. Min. and Met. Eng., vol. 28, 1945, pp. 85–110.

furnaces canvassed were using the conventional magnesite-slag bottom; only 72, however, stated a preference for this type of bottom over other bottoms. Plastic chrome ore subhearths with magnesite surfaces were used in 82 furnaces; the respondents reported that this number would be increased to 135 in future rebuilding. The greatest increase, however, may be anticipated in rammed construction. At the time of the questionnaire, 126 of the 610 bottoms were rammed, 61 being unsurfaced, 38 surfaced with magnesia, and 27 with dolomite-magnesia surfacing materials. The replies showed that 355 furnaces would be converted to rammed bottoms, 96 using no surfacer, 132 using magnesia on an 80-percent magnesia bottom, 108 using magnesia on a 70-percent magnesia bottom, and 19 using magnesia-dolomite on a 70-percent magnesia bottom.

Magnesia sold or used by producers in the United States, 1944–45, by kinds and sources

[Quantities and values reported apply to finished products, not raw materials]

Finished product	From magnesite, brucite, and dolomite		From well brines, raw sea water, and sea-water bitterns	
	Short tons	Value	Short tons	Value
1944				
Caustic-calcined	99,063	$4,366,474	40,180	$2,115,489
Refractory	220,583	5,943,480	57,907	2,482,569
	319,646	10,309,954	98,087	4,598,058
1945				
Caustic-calcined	16,098	1,122,119	27,172	1,381,425
Refractory	193,693	5,068,987	61,301	2,345,231
	209,791	6,191,106	88,473	3,726,656

Magnesite imported for consumption in the United States, 1943–45, by countries

Country	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
CRUDE MAGNESITE						
Cuba			47	$857		
U. S. S. R.			992	33,731		
			1,039	34,588		
LUMP CAUSTIC-CALCINED MAGNESITE						
Canada			3	$82	(1)	$9
Cuba	174	$7,497				
India and Dependencies			551	14,748	443	11,820
United Kingdom			5	456		
	174	7,497	559	15,286	443	11,829
GROUND CAUSTIC-CALCINED MAGNESITE						
Cuba	106	$4,750				
United Kingdom	10	875			2	$305
	116	5,625			2	305
DEAD-BURNED AND GRAIN MAGNESITE AND PERICLASE						
Australia					33	$1,024
Canada	147	$14,319	780	$76,263	746	72,788
U. S. S. R.	9,086	296,178	5,396	183,799	4,727	160,707
	9,233	310,497	6,176	260,062	5,506	234,519

[1] Less than 1 ton.

Although the conventional magnesite-slag hearth appears to be on the decline in a hearth of customary construction, experiments with the all-basic furnace indicate that a burned-in magnesite hearth is necessary in the higher temperatures possible with a basic roof. Also, it has been shown that the advantages of the high magnesia content of magnesite grain may be retained without the disadvantage of having to burn it in for 14 to 16 days, if the magnesite grain is crushed fine and 10 percent slag is added. Dense layers 4 inches thick may be sintered in 30 hours, it is claimed.[3]

A disadvantage of rammed mixes is their low bulk specific gravity compared to that of sintered magnesite. Cores taken from the flat of a rammed bottom showed bulk specific gravities ranging from 2.24 to 2.62, compared with 3.12 for cores of sintered grain magnesite. Snow has pointed out that the usual method of wetting the ramming mix is partly responsible for the low density. As the mix is received in the plant, it contains enough fines to fill pore space between grains. The mix must be wetted to render it workable, and this is done in a concrete mixer. The fines aggregate as balls and contribute nothing to filling pore space.[4] A nonrotary mixing method may be indicated.

Sosman summarized the advantages and disadvantages of all-basic open hearth. Advantages are (1) increased speed of melting, (2) longer life of furnace, (3) less silica in slag, and (4) easier cleanout of slag pockets. Disadvantages were stated to be higher initial cost and greater weight.[5]

The United States Tariff Commission prepared a valuable economic study on magnesite.[6]

PRICES

Except for the withdrawal of mined periclase from the market in 1944, the prices of magnesias listed by Westvaco Chlorine Products Corp. were the same in 1945 as in 1944, as follows (carlots f. o. b. Calif.): Caustic-calcined magnesite, bulk—$52.75, powdered—$58.75; calcined (sea-water) magnesia, bulk—$54, powdered—$60; sea-water periclase, bulk, 85 percent—$36, 90 percent—$36.50. Dead-burned grain magnesite, as sold by Northwest Magnesite Co., remained at $22 a short ton f. o. b. Chewelah, Wash. There has been little fluctuation in this quotation since 1928.

On August 4, the Office of Price Administration issued ceiling prices for magnesia ramming mixes, as follows:

Brand	Producers	Price per net ton in sacks
H-W Magnamix	Harbison-Walker Refractories Co	$54.00
Magnehearth	General Refractories Co	54.00
Ramix	Basic Refractories, Inc	56.00
Basimix	do	66.50
Basiplast	do	66.50
Standard cold patch	Standard Lime & Stone Co	56.00

In general, the prices are f. o. b. plant. Details are given in the Federal Register, August 7, 1945, p. 9716.

[3] Snow, R. B., The Density of Open-Hearth Bottoms: Proc., Open-Hearth Conference, Am. Inst. Min. and Met. Eng., vol. 28, 1945, p. 115.

[4] Snow, p. 112 of work cited in footnote 3.

[5] Sosman, R. B., The Outlook for an All-basic Open-Hearth: Proc., Open-Hearth Conf., Am. Inst. Min. and Met. Eng., vol. 28, 1945, pp. 54–68.

[6] United States Tariff Commission, Refractory Magnesia (Magnesite): War Changes in Industry Series Report No. 12, 1945, 55 pp.

REVIEW BY STATES

California.—Johns-Manville Corp., 22 East Fortieth Street, New York 16, N. Y., recovered purified magnesium carbonate from magnesite at Redwood City for use in 85-percent magnesia insulation. Marine Magnesium Products Corp., South San Francisco, continued its output of specialty magnesias, using as raw materials lime, dolomite, and the waters of San Francisco Bay. Permanente Metals Corp. operated its magnesia-from-seawater plant at Moss Landing during the early part of the year for use in its own magnesium metal-reduction plant at Manteca and also for making refractory magnesia for shipment. Plant Rubber & Asbestos Works, 537 Brannan Street, San Francisco, Calif., made 85 percent magnesia at its Emeryville and Redwood City plants. Westvaco Chlorine Products Corp., Newark, Calif., stopped production temporarily at its Western mine at Livermore owing to increasing mining costs. Magnesite from the mine formerly was calcined to a dense periclase, but now the firm has discovered a method of obtaining a comparable periclase from its well-known sea-water magnesia. The producer also reports that a new improved magnesia is on the market for use in oxychloride cements consisting of about two-thirds caustic-calcined magnesite (from Gabbs, Nev.) and one-third caustic-calcined sea-water magnesia.

Georgia.—International Minerals & Chemical Corp., 20 North Wacker Drive, Chicago 6, Ill., produced epsom salt from serpentine and sulfuric acid at its Augusta plant.

Illinois.—Johns-Manville Corp., 22 East Fortieth Street, New York 16, N. Y., produced precipitated magnesium carbonate by the Pattinson process for use in 85 percent magnesia insulation at its Waukegan plant.

Michigan.—The Dow Chemical Co., Midland, Mich., continued its production of magnesium chloride and sulfate from well brines and dolomite. The Defense Plant Corporation at Ludington, formerly operated by Dow Magnesium Corp. for the recovery of magnesium chloride, was closed during the year. Michigan Chemical Corp., St. Louis, Mich., recovered magnesia from dolomite and well brines. Morton Salt Co., 310 South Michigan Avenue, Chicago 4, Ill., produced precipitated magnesium carbonate from lime and well brines at its Manistee plant.

Nevada.—Basic Refractories, Inc., mined brucite at Gabbs for shipment to Narlo, Ohio, for calcining and manufacture into basic open-hearth dressings and ramming mixes. Sierra Magnesite Co., Newark, Calif., an association joining the interests of Westvaco Chlorine Products Corp. and Henry Kaiser and associates, continued to mine magnesite at Gabbs, all for "caustic-calcined" uses.

New Jersey.—Johns-Manville Corp., 22 East Fortieth Street, New York 16, N. Y., produced precipitated magnesium carbonate by the Pattinson process for use in 85 percent magnesia insulation at its Manville plant. Northwest Magnesite Co., 1800 Farmers Bank Building, Pittsburgh 2, Pa., recovered refractory magnesia from raw sea water at its Cape May plant.

Ohio.—Diamond Alkali Co., Oliver Building, 535 Smithfield Street, Pittsburgh 22, Pa., processed magnesium chloride from dolomite and waste calcium chloride liquors at its Fairport, Ohio, plant for sale to the nearby Defense Plant Corporation magnesium reduction plant.

Pennsylvania.—Three firms used the Pattinson process in making magnesium carbonate for 85 percent magnesia insulation and other purposes in the Philadelphia area, namely the Philip Carey Manufacturing Co., 1935 Easton Boulevard, Lockland 15, Cincinnati, Ohio, plant at Plymouth Meeting, Pa.; Ehret Magnesia Manufacturing Co., Valley Forge Pa.; and Keasbey & Mattison Co., Butler Avenue and Maple Street, Ambler, Pa. General Magnesite & Magnesia Corp., 2960 East Venango Street, Philadelphia 34, Pa., made magnesium oxide from purchased magnesium carbonate.

Texas.—Arizona Chemical Co., 30 Rockefeller Plaza, New York 20, N. Y., recovered anhydrous magnesium sulfate from well brines at O'Donnell. The plant has since been dismantled, and there will be no further operation, it was stated. Dow Magnesium Corp., Freeport, Tex., and Defense Plant Corporation, Freeport, Tex. (operated by Dow Magnesium Corp.), recovered magnesium chloride from sea water for use in making magnesium metal. Gardner and Cates, Llano, Tex., made caustic-calcined magnesite with two kilns for fertilizer use.

Washington.—Northwest Magnesite Co., 1800 Farmers Bank Building, Pittsburgh, Pa., was the sole producer of refractory magnesite in 1945, mining and calcining at Chewelah. Wicken [7] reviewed the current process of separating crushed quartz, talc, and dolomite from magnesite by means of ferrosilicon heavy media.

West Virginia.—The Standard Lime & Stone Co. continued its recovery of refractory magnesia by leaching dolomite at its Millville plant, where magnesium carbonate also is produced by the Pattinson process for 85 percent magnesia insulation.

FOREIGN COUNTRIES

Information of foreign developments in magnesite has been meager since the outbreak of the war. The latest Minerals Yearbook table showing world production by countries appeared in the volume reviewing 1939. During the 5-year period 1934–38, the U. S. S. R. produced annually about 534,000 short tons, Austria 403,000 tons, Manchuria, 233,000 tons, United States 157,000 tons, Greece 134,000 tons, and Czechoslovakia 83,000 tons.

Owing largely to the efforts of the mineral attachés of the Bureau of Mines and the consular offices of the State Department, production data and other information for some of the smaller producing countries have been received recently, as follows:

Brazil.—Magnesita S. A. stated that it would produce high-quality magnesite refractory brick and metallic magnesium from its deposits in Baía.[8]

Germany.—Prussian magnesite production, 1938–42, has been reported as: 1938, 23,860 metric tons; 1939, 24,065 tons; 1940, 23,576 tons; 1941, 28,716 tons; and 1942, 25,407 tons.[9]

[7] Wicken, O. H., Urgent Demand for Vital Magnesite Met by Using Sink and Float System: Pit and Quarry, vol. 37, No. 10, April 1945, pp. 83–88.
[8] Bureau of Mines Mineral Trade Notes, vol. 22, No. 1, January 20, 1946, p. 36.
[9] Bureau of Mines Mineral Trade Notes, vol. 21, No. 2, August 20, 1945, p. 35.

India.—Several known occurrences of magnesite in the Salem and Trichinopoly districts were examined by the Geological Survey of India, and reserves were estimated at about 82,650,000 long tons. The average MgO content was reported as 31.5 percent.[10]

Italy.—Production during the period 1936–43 was reported as follows, in metric tons: 1936, 3,155; 1937, 5,392; 1938, 6,157; 1939, 14,977; 1940, 5,055; 1941, 4,587; 1942, 13,686; and 1943 (first 6 months), 2,876.[11]

Spain.—Production of dead-burned magnesite totaled 6,693 metric tons in 1945, compared with 7,276 tons in 1944.

Sweden.—An important deposit of magnesite discovered some 10 years ago in the Arctic region of Sweden (Sarek National Park) is now being worked as an emergency measure because of lack of imported material. The mineral is transported by sleds, planes, river boats, and by rail to refractory plants.

Turkey.—During 1944, 797 metric tons of magnesite were produced from four deposits in the Province of Eskisehir, compared with 137 tons in 1943.[12]

DOLOMITE

The tapering off of war demands upon the steel industry in the last half of 1945 was reflected in an 8-percent decrease in dead-burned dolomite sold or used by producers in 1945. Imports remained negligible.

Dead-burned dolomite sold in and imported into the United States, 1941–45

Year	Sales		Imports [1]		Year	Sales		Imports [1]	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1941	1,069,887	$9,111,172	64	$654	1944	1,290,790	$11,441,612	40	$691
1942	1,229,357	10,817,634	449	11,260	1945	1,187,334	10,613,711	73	33
1943	1,276,725	11,243,017	739	22,563					

[1] Reported as "Dead-burned basic refractory material."

Interest in the recovery of magnesia from dolomite continued in 1945. References are listed in the footnote.[13]

The old problem of preventing dead-burned dolomite from absorbing water vapor and carbon dioxide received attention. Syz[14] suggested that dolomite be calcined with fluorspar (1.5 to 3 percent) at 900° to 1,000° C.

Additional information on dolomite will be found in the chapter on Stone of this volume.

[10] Bureau of Mines Mineral Trade Notes, vol. 22, No. 2, February 20, 1946, p. 45.
[11] Bureau of Mines Mineral Trade Notes, vol. 21, No. 6, December 20, 1945, p. 35.
[12] Bureau of Mines Mineral Trade Notes, vol. 22, No. 1, January 20, 1946, p. 36.
[13] Doerner, H. A., Holbrook, W. F., and Fortner, O. W., The Bicarbonate Process for the Production of Magnesium Oxide; Bureau of Mines Tech. Paper 684, 1946, 48 pp.
Lee, H. C., Lee, E. K., and Schoenlaub, R. A., Treatment of Lime-Containing Raw Materials: United States Patent 2,382,886, August 14, 1945.
Pike, R. D., Production of Magnesia and Calcium Carbonate from Dolomite: United States Patent 2,373,911, April 17, 1945.
———, Production of Magnesia from Dolomite: United States Patent 2,373,912, April 17, 1945.
———, Production of Magnesia and Calcium Carbonate from Dolomite: United States Patent 2,373,913, April 17, 1945.
Thomsen, A. M., Method of Making Magnesia from Dolomite: United States Patent 2,377,592, June 5, 1945.
Wing, Wallace E., Method of Separating Magnesia from Dolomite: United States Patent 2,386,027, October 2, 1945.
[14] Syz, Werner, Process of Producing Burnt Dolomite: United States Patent 2,380,480, July 31, 1945.

OTHER MAGNESIUM COMPOUNDS

Curtailment in magnesium-metal manufacture accounted for the severe drop in production of magnesium chloride. As peacetime uses of magnesium sulfate as a rayon coagulant, in stock feeds, and as a fertilizer are substantial, production in 1945 increased. The Bureau of Mines in 1945 attempted a breakdown of U.S.P. and technical magnesias according to "lightness." It was found that there were not enough producers to show total production of each grade; therefore, only "extra-light" with four producers was shown separately. (See accompanying table.)

Specified magnesium compounds produced, sold, and used by producers in the United States, 1944–45

Product	Plants	Produced (short tons)	Sold [1]		Used (short tons)
			Short tons	Value	
1944					
Specified magnesias and magnesium hydroxide:					
U. S. P. and technical magnesia, basis 100-percent MgO:					
Extra-light	(2)	(2)	(2)	(2)	(3)
Heavy, light, and magnesium hydroxide	(2)	(2)	(2)	(2)	(3)
Total	5	[4] 4,694	4,391	$923,695	(3)
Precipitated magnesium carbonate	10	52,918	4,845	448,619	47,917
Magnesium chloride, 100-percent basis	11	525,223	19,086	[5] 720,926	509,365
Magnesium sulfate, 100-percent basis	3	25,316	25,565	1,289,448	--------
1945					
Specified magnesias and magnesium hydroxide:					
U. S. P. and technical magnesia, basis 100-percent MgO:					
Extra-light	4	732	805	318,277	--------
Heavy, light, and magnesium hydroxide	3	1,479	1,260	421,501	(3)
Total	[6] 5	[4] 2,211	2,065	739,778	(3)
Precipitated magnesium carbonate	11	50,205	8,469	812,791	41,794
Magnesium chloride, 100-percent basis	5	121,475	(7)	(7)	104,081
Magnesium sulfate, 100-percent basis	3	27,610	27,142	1,377,311	--------

[1] Sales by a producer to an affiliated consumer for immediate use are not included under "Sold" but are under "Used." [2] Included in total; not available separately. [3] Magnesia and magnesium hydroxide used by producing firms in making other magnesias are not shown. [4] Exclusive of magnesia made from magnesium hydroxide, to avoid duplication. [5] Revised figure. [6] A plant producing more than 1 grade or product is counted but once in arriving at total. [7] Bureau of Mines not at liberty to publish figures.

Magnesium compounds imported for consumption in the United States, 1941–45

Year	Magnesium chloride (anhydrous and n. s. p. f.)		Magnesium sulfate (epsom salts)		Oxide or calcined magnesia		Magnesium carbonate, precipitated		Magnesium salts and compounds, n. s. p. f.[1]	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	28	$1,328	1	$179	12	$4,292	1,106	$113,236	23	$11,488
1942	186	115,025	--------	--------	16	5,487	640	70,756	13	6,701
1943	--------	--------	--------	--------	(2)	1	122	17,730	21	16,645
1944	--------	--------	22	1,812	30	9,485	151	26,703	22	12,799
1945	2	222	(3)	2	--------	--------	66	15,836	23	18,938

[1] Magnesium silicofluoride or fluosilicate included under "Magnesium salts and compounds, n. s. p. f."
[2] 50 pounds.
[3] 20 pounds.

Magnesium hydroxide, medicinal grade, according to the Oil, Paint and Drug Reporter, was quoted at 29 to 30 cents a pound in 1945 (same as in 1944); magnesium carbonate, technical, bags, carlots, northern Atlantic Coast States, 7¼ cents a pound; U.S.P. grade, 8 cents (1944: technical 6¼, U. S. P. 8). Magnesium chloride, flake, barrels, carlots, works, was quoted at $32 a ton, the same as in 1944. Magnesium sulfate, fertilizer grade, 65 percent, bags, carlots, delivered at eastern consuming points, was quoted at $59.50 a ton; industrial grade, 80 percent, 5 to 5¾ cents a pound.

Part II.—MISCELLANEOUS SALINES

CALCIUM CHLORIDE

The main use of calcium chloride is in stabilizing rural roads; it is generally bladed into the road during the spring while the roadbed is moist and pliant. In the spring of 1945, despite the great shortage in road-repair labor, substantial quantities of calcium chloride were consumed, as in years past.

Calcium chloride is also used in concrete mixes to obtain early high strength, and in freeze-proofing coal and ores in freight cars. Recent experimental uses in fog-dispersing [15] and in preservation of tobacco seed [16] have been discussed in the press.

Calcium chloride and calcium-magnesium chloride from natural brines sold by producers in the United States, 1941–45

[In terms of 75 percent (Ca, Mg) Cl_2]

Year	Short tons	Value	Year	Short tons	Value
1941	165,932	$1,333,370	1944	200,964	$1,621,227
1942	224,527	1,733,169	1945	218,320	1,818,219
1943	199,796	1,549,565			

Calcium chloride imported for consumption and exported from the United States, 1941–45

Year	Imports		Exports	
	Short tons	Value	Short tons	Value
1941	7	$795	20,777	$511,366
1942	1,443	18,926	8,336	223,184
1943	8,000	102,080	12,725	434,933
1944	2,761	35,125	8,534	233,641
1945	4,040	51,409	6,871	188,141

There were 10 producers of calcium chloride in 1945 and 12 in 1944. The following firms reported production of calcium chloride (and calcium-magnesium chloride) from natural brines in 1945: California Rock Salt Co., 2436 Hunter Street, Los Angeles 21, Calif., plant at Amboy, Calif.; J. Q. Dickinson & Co., Malden, W. Va.; Dow Chemical Co., Midland, Mich.; Hill Brothers Chemical Co., 2159 Bay Street,

[15] Calcium Chloride Association News, vol. 11, No. 6, December 1945, pp. 1, 11; also vol. 12, No. 2, April 1946, p. 4.

[16] Calcium Chloride Association News, vol. 12, No. 1, February 1946, p. 9.

Los Angeles 21, Calif., plant at Amboy, Calif.; Liverpool Salt Co., Hartford, W. Va.; Michigan Chemical Corp., St. Louis, Mich.; National Chloride Co., Amboy, Calif.; Rademaker Chemical Corp., Eastlake, Mich.; and Westvaco Chlorine Products Corp., 405 Lexington Avenue, New York 17, N. Y., plants at Chula Vista, Calif., and South Charleston, W. Va.

BROMINE

Sales of bromine compounds by primary producers amounted to 79,709,857 pounds of contained bromine in 1945, a drop of 22 percent from the historical record of 102,112,462 pounds produced in 1944. With the exception of a few percent used in photographic emulsions and laboratory reagents, almost all bromine produced in the United States is added to ethylene to produce ethylene dibromide, an almost indispensable assister for the gasoline antiknock, tetraethyl lead.

Bromine and bromine in compounds sold or used by producers in the United States, 1941–45

Year	Pounds	Value	Year	Pounds	Value
1941	68, 317, 019	$11, 506, 213	1944	102, 112, 462	$19, 712, 819
1942	65, 880, 935	13, 729, 383	1945	79, 709, 857	14, 796, 229
1943	94, 085, 937	19, 107, 065			

Bromine and bromides sold by primary producers in the United States, 1944–45

	1944			1945		
	Pounds	Value	Bromine content (pounds)	Pounds	Value	Bromine content (pounds)
Elemental bromine	3, 742, 307	$766, 059	3, 742, 307	2, 157, 820	$379, 336	2, 157, 820
Sodium bromide	1, 452, 901	273, 839	1, 133, 263	1, 203, 398	242, 758	938, 650
Potassium bromide	2, 687, 604	586, 948	1, 800, 695	3, 152, 080	626, 255	2, 111, 894
Ammonium bromide	438, 953	111, 910	359, 941	482, 749	108, 930	395, 854
Other, including ethylene dibromide	112, 281, 833	17, 974, 063	95, 076, 256	87, 484, 382	13, 438, 950	74, 105, 639
	120, 603, 598	19, 712, 819	102, 112, 462	94, 480, 429	14, 796, 229	79, 709, 857

According to Oil, Paint and Drug Reporter, potassium and sodium bromides, U. S. P., granular, 500-pound barrels, works, were quoted at $0.25 a pound in 1945. Bottled elemental bromine in cases, carlots, works, was quoted at $0.21 a pound. The same prices prevailed in 1944.

Ethyl-Dow Chemical Co., the largest producer, recovered bromine from sea water at its Wilmington, N. C., and Freeport, Tex., plants. Dow Chemical Co., Midland, Mich., second-largest producer, recovered bromine from Michigan well brines as a byproduct of magnesium and calcium chlorides. American Potash & Chemical Corp., Trona, Calif., recovered bromine from Searles Lake, and Westvaco

Chlorine Products Corp., Newark and Chula Vista, Calif., from sea-water bitterns. The following won bromine from well brines: Great Lakes Chemical Corp., Filer City, Mich.; Michigan Chemical Corp., St. Louis, Mich.; Morton Salt Co., Manistee, Mich.; Rademaker Chemical Corp., Eastlake, Mich.; and Westvaco Chlorine Products Corp., South Charleston, W. Va.

IODINE

Imports of iodine (all from Chile) dropped sharply in 1945 owing to the wartime accumulation of large stocks by the Chile Nitrate Sales Corp. (sales agent for producers of iodine from caliche in Chile). Although the bulk of domestic consumption is supplied by imports, a fair share of the market is enjoyed by two California firms that recover iodine from oil-well brines, namely, Dow Chemical Co., Midland, Mich., plant at Seal Beach, Calif., and Deepwater Chemical Co., Ltd., Victoria Avenue, Compton, Calif. The latest year for which figures on domestic production may be shown is 1937, when 299,286 pounds valued at $242,422 were produced. Output in recent years has been considerably higher.

The time-honored use of iodine is as a disinfectant, and despite the trend in medical thinking toward asepsis rather than antisepsis, there will probably be a place for the iodine bottle in the home medicine chest for years to come. Iodine is also used (as iodides) in photographic emulsions, in organic syntheses, and in foodstuffs to prevent goiter.

Crude iodine imported for consumption in the United States, 1941–45

Year	Pounds	Value	Year	Pounds	Value
1941	1,010,039	$1,121,513	1944	1,204,303	$1,321,274
1942	951,243	1,051,432	1945	220,526	232,070
1943	2,744,930	3,041,609			

The price of crude iodine has been frozen by the Office of Price Administration at $1.28¼ per pound in 150-pound kegs since 1942. Resublimed iodine in 5-pound bottles sold at $2 to $2.10 a pound during 1945.

SODIUM SULFATES AND CARBONATES

Sales of natural sodium sulfates and carbonates increased in 1945 over 1944, carbonate sales establishing a new record. Natural sodium sulfate is used principally in the West and South in the manufacture of kraft paper, glass, in stock feeds, and as a flux in metallurgy. Natural sodium carbonate is consumed principally on the Pacific coast, where it is used in glass manufacture and in alkali cleansers.

Natural sodium sulfates and sodium carbonates sold or used by producers in the United States, 1941–45

Year	Sodium sulfates [1]		Sodium carbonates [2]	
	Short tons	Value	Short tons	Value
1941	154,327	$1,443,137	146,677	$1,822,986
1942	169,870	1,669,983	150,619	2,145,289
1943	160,622	1,553,549	165,993	2,544,086
1944	168,923	1,577,982	184,826	2,869,243
1945	178,196	1,525,159	194,045	3,034,118

[1] Tonnage figures for sulfates include Glauber's salt converted to 100 percent Na_2SO_4 basis. In earlier chapters of this series the figures given for sulfates include those for Glauber's salt not so converted and were as follows—1941: 157,524 tons; 1942: 175,033 tons; and 1943: 165,908 tons. Figures for 1941–42 include some burkeite.

[2] 1941: Soda ash, bicarbonate, and trona; 1942–45: Soda ash and trona.

The following firms reported production of natural sodium sulfates: American Potash & Chemical Corp., 122 East Forty-second Street, New York City, plant at Trona, Calif.; Arizona Chemical Co., 30 Rockefeller Plaza, New York City, plants at O'Donnell and Brownfield, Tex.; Iowa Soda Products Co., Council Bluffs, Iowa, plant at Rawlins, Wyo.; Ozark Chemical Co., Post Office Box 449, Tulsa, Okla., plant at Monahans, Tex.; and Wm. E. Pratt, Post Office Box 738, Casper, Wyo.

The following firms reported production of natural sodium carbonates: American Potash & Chemical Corp., Trona, Calif.; Natural Soda Products Co., 405 Montgomery Street, San Francisco 4, Calif., plant at Keeler; Pittsburgh Plate Glass Co., Columbia Chemical Division, Bartlett, Calif.; and West End Chemical Co., 608 Latham Square Building, Oakland 12, Calif., plant at Westend.

Production of sodium sulfate in the United States, 1941–45, in short tons [1]

Year	Glauber's salt and salt cake (crude)[2]	Anhydrous (refined) 100 percent Na_2SO_4	Total
1941	721,796	54,248	776,044
1942	793,409	57,735	851,144
1943	805,257	64,219	869,476
1944	799,596	75,482	875,078
1945	755,397	83,201	838,598

[1] Source: U. S. Bureau of the Census.

[2] Includes natural sodium sulfate as shown in previous table.

Domestic salt cake was quoted at $15 a short ton, bulk, works; anhydrous sodium sulfate at $1.70 per hundredweight, works; and Glauber's salt at $1.05 to $1.45 per hundredweight in 1945, according to Oil, Paint and Drug Reporter. These prices are presumably for byproduct sodium sulfate, both crude and refined, as natural sodium sulfate, although pure enough (98 percent plus) to be classed as anhydrous grade, generally sells for somewhat lower prices. Soda ash, calcined sodium carbonate, light, bags, carlots, works, was quoted at $1.05 to $1.18 a hundredweight.

Production data for sodium carbonate produced by the ammonia-soda process for the last 5 years, according to the Bureau of the Census, are: 1941, 3,606,826 short tons; 1942, 3,788,583; 1943, 4,407,618; 1944, 4,538,398; and 1945, 4,375,017 tons.

Estimated consumption of sodium carbonate in the United States, 1941–45, by industries, in short tons [1]

Industry	1941	1942	1943	1944	1945
Glass	990,000	1,100,000	1,200,000	1,290,000	1,320,000
Soap	170,000	165,000	150,000	162,000	140,000
Caustic and bicarbonate	1,033,000	960,000	1,010,000	1,033,000	1,076,000
Other chemicals	800,000	840,000	950,000	1,025,000	960,000
Cleansers and modified sodas	70,000	80,000	85,000	90,000	90,000
Pulp and paper	155,000	145,000	155,000	160,000	165,000
Water softeners	70,000	80,000	95,000	110,000	100,000
Petroleum refining	23,000	18,000	20,000	22,000	24,000
Textiles	60,000	56,000	58,000	61,000	68,000
Nonferrous metallurgy	150,000	260,000	450,000	340,000	220,000
Miscellaneous	225,000	230,000	370,000	400,000	350,000
	3,746,000	3,934,000	4,543,000	4,693,000	4,513,000

[1] Chemical and Metallurgical Engineering—1941–43: Vol. 51, No. 2, February 1944, p. 113; 1944–45: Vol. 53, No. 1, January 1946, p. 101.

Sodium sulfate imported for consumption in the United States, 1940–45

Year	Crude (salt cake)		Crystallized (Glauber's salt)		Anhydrous		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1940	73,027	$1,009,694	1	$53	32	$741	73,060	$1,010,488
1941	75,571	850,589	26	1,045	8	189	75,605	851,823
1942	93,661	1,324,256	22	711			93,683	1,324,967
1943	32,790	466,272			7	477	32,797	466,749
1944	31,305	446,935					31,305	446,935
1945	20,293	289,940					20,293	289,940

Sodium metal.—Sodium metal is produced by two firms, E. I. du Pont de Nemours & Co., Inc., at Niagara Falls, and Ethyl Gasoline Corp., at Baton Rouge, La. It is used principally in the manufacture of tetraethyl lead, the gasoline antiknock, but large quantities are consumed in making sodium peroxide, sodium cyanide, pharmaceuticals, rubber accelerators, and in descaling steel. From November 15, 1943, until the end of the war, sodium was allocated under M–300–16 to obtain adequate quantities for making tetraethyl lead.

The price of sodium metal in 1945 remained at 15 cents a pound in blocks, carlots, works, the same as in 1944.

BORATES

Reconversion of the refrigerator, washing machine, and ceramic industries brought about the greatest production of boron minerals since 1937. Production, which had been mounting steadily since the wartime low of 226,723 short tons in 1942, reached 325,935 tons in 1945, or, in terms of B_2O_3 content, 104,600 short tons in 1945, as against 77,600 tons in 1942.

Besides being an essential ingredient of the enamel on sheet steel articles, boron minerals are also used in glass (the main wartime use), water treatment, soaps, medicines, ferrous alloys, flame-resisting paints, and fertilizers. The United States is the world's main source of boron minerals, in normal times exporting one-third to one-half of production.

Salient statistics of the boron-mineral industry in the United States, 1941–45

	1941	1942	1943	1944	1945
Sold or used by producers: [1]					
Short tons:					
Gross weight	301, 282	226, 723	256, 633	277, 586	325, 935
B_2O_3 content	95, 200	77, 600	87, 600	91, 700	104, 600
Value	$6, 785, 662	$5, 733, 648	$6, 401, 507	$6, 579, 587	$7, 635, 365
Imports for consumption (refined): [2]					
Pounds	2, 025				1, 344
Value	$92				$491
Exports:					
Short tons	41, 793	36, 542	26, 877	32, 759	43, 577
Value	$1, 893, 500	$1, 562, 794	$1, 282, 372	$1, 601, 014	$2, 064, 065
Apparent consumption: [3]					
Short tons	259, 490	190, 181	229, 756	244, 827	282, 359

[1] 1941: Borax, kernite, boric acid, and colemanite; 1942–45: Borax, anhydrous sodium tetraborate, kernite, boric acid, and colemanite.
[2] Also 525 pounds of crude valued at $7 in 1943.
[3] Quantity sold or used by producers plus imports minus exports.

In 1945 the following firms reported production of boron minerals: American Potash & Chemical Corp., 122 East Forty-second Street, New York City, plant at Trona, Calif., on Searles Lake; Pacific Coast Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine at Boron; United States Borax Co., 510 West Sixth Street, Los Angeles 14, Calif., mine near Shoshone; West End Chemical Co., 608 Latham Square Building, Oakland, Calif., plant at Westend, on Searles Lake.

On July 27, 1945, the Pacific Coast Borax Co. brought motions to dismiss the antitrust suits filed against it and the American Potash & Chemical Corp. involving an alleged conspiracy to monopolize the boron industry. The court denied the motion,[17] and on August 16, 1945, the defendants entered into a consent decree, paying fines and waiving claims to certain properties.[18]

The new boric acid plant of Pacific Coast Borax Co., begun in 1944 and completed in the latter part of 1945, contributed materially to the supply of boric acid.

An interesting flow sheet of the borax and allied processes of American Potash & Chemical Corp. at Trona, Calif., appeared.[19]

The methods of mining crude rasorite utilized by Pacific Coast Borax Co. were reviewed.[20]

The price of technical borax, 99½ percent, granular, bulk, carlots, freight allowed, remained at $41.50 a short ton throughout 1945; this price has prevailed for several years.

[17] *United States* v. *Borax Consolidated, Ltd., et al.*, District Court, Northern District, California, Southern District, 62 Fed. Sup. 220.
[18] The Chemical Age, Borax Companies Fined in U. S. Antitrust Suit, vol. 53, No. 1365, August 25, 1945, p. 176.
Chemical and Engineering News, Borax Firms Fined, vol. 23, No. 17, September 10, 1945, p. 1540.
[19] Chemical and Metallurgical Engineering, Searles Lake Chemicals, vol. 52, No. 10, pp. 134–137.
[20] The Glass Industry, vol. 26, No. 10, October 1945, p. 458.

GEM STONES

By Sydney H. Ball

SUMMARY OUTLINE

JEWELRY INDUSTRY IN 1945

Jewelry sales (taxable) reached a peak in 1945 (tax, $198,944,988); in consequence, retail jewelry-store sales—considering nontaxable sales together with taxable sales by department stores and others—amounted to about $1,200,000,000, an all-time peak and a gain of some 12 percent over 1944. Sales in the first quarter of the year were distinctly below those of 1944; from April to July they exceeded those of 1944 by 20 percent. The surrender of Japan in August decreased but did not stop increased sales in August and September, and in the last quarter of the year sales forged ahead. Montana, Texas, and Utah showed particularly large gains. Christmas time sales reached unusual proportions. Admittedly, certain stocks were in short supply, but the populace had money and bought what was available. All holiday records were exceeded. Jewel sales, generally including diamonds, in five figures were not unusual. Americans were not the only heavy buyers; Brazilians and South Africans were equally extravagant. Retail jewelers' stocks in America decreased somewhat during the year.

Sales by wholesale jewelry houses were up slightly from those of 1944, and in dollar value their inventories increased slightly in 1945. The wholesale trade centers in New York City.

Jewelry prosperity in 1945 was built upon the people's large wartime savings; demobilized GI's returning home with their savings; a high national income; a flood of marriages (only slightly below the 1943 peak); and the dearth of other durable goods to attract money from the industry. It should, however, be emphasized that in the past decade wealth has shifted from the "400" to the medium- and lower-income brackets. The carriage trade is almost extinct, and hereafter the retailers will sell fewer expensive items and more medium- and low-priced goods.

The numerous women gainfully employed during the past 6 years have, on the average, spent more money on clothing and luxuries than the housewives. In department stores particularly, sales of medium- to high-priced costume jewelry have expanded the business of the jewelry departments.

Some jewelers anticipate a recession in sales; in consequence, the Jewelry Industry Publicity Board has had a study made of conditions in the industry, in the hope of maintaining activity in the future.

FASHIONS IN JEWELS

More jewelry was worn in 1945 than ever before. Platinum is again available for mounting, and we may expect to see palladium relegated to the side lines, except in earrings and certain clips, where its lightness is a distinct advantage. Stones mounted in invisible settings are particularly attractive. Two-toned gold retains its popularity.

In view of the shortage of skilled goldsmiths, the work of the designers merits praise. On the whole, designs were lighter and more artistic than in recent years. The three most popular motifs—flowers (sometimes in sprays or bouquets); sunburst, star, and snowflake designs; and leaves—were attractive.

Necklaces, particularly the flexible type fitting snugly to the neck, were fashionable. Clips were worn not only on dresses but attached to the necklace and on the hat. Earrings were in vogue due to the up-swept hair mode. Bracelets, singly or in groups, are as popular as ever. Rings were characterized by high pavé-domes, set with small stones rather than single gems. More and more they are being worn over gloves. Lanyards and barrettes, bandeaus, and stars for the hair are gaining in popularity.

Old jewelry is still sold but was a less-important element in the trade than in 1944.

Ensemble jewelry, three or four pieces set with the same gem, finds ready sale, as does jewelry that may be divided into two or more pieces as need arises. The double wedding-ring ceremony is now standard.

Marquise and other unusual diamond cuts are gaining in favor. Small diamonds for mountings are still in short supply, hence tiny cabochon rubies and sapphires in part supplant them. Diamond, ruby, and sapphire, including the lighter-color Ceylonese stones, led in popularity, followed by the yellow-brown gems (topaz and citrine), pearl, amethyst, turquoise, and aquamarine. Aquamarine held its own; amethyst and turquoise gained; but citrine and topaz, to a considerable extent, lost their appeal. The emerald had pride of place among the sophisticated.

The ever-insistent demand for diamonds caused colorless gems to be most popular, followed by red and blue gems; yellow, purple, and green gems were in lesser demand, in the order named.

DOMESTIC PRODUCTION

Mining for gold and mining for gem stones have been affected by war more adversely than any other branches of the industry. Production value of gem stones in 1945 dropped to about $40,000, the lowest in a decade. The decline is attributed to shortages of labor, mining supplies, tires, and gasoline. The gem hobbyists and the amateur and semiprofessional lapidaries could not replenish their stocks of rough; and most of their best customers, the touring automobilists, stayed at home. Further, the supply of most strategic minerals became adequate early in the year, and pegmatite mining waned. It should be stated, however, that pegmatite mining during the war furnished disappointingly few gem stones. Late in the year, gasoline and other supplies became available; and this, with the return of men from the war, will doubtless encourage greater production in 1946.

Oregon and Washington lapidaries were active in 1945. There are at least 50 shops, and the value of the 1945 output is variously estimated at $100,000 to $500,000.

For the first time the value of jade produced certainly exceeded that of sapphire and probably that of turquoise. In 1945 Wyoming produced a number of tons of light-green nephrite and almost as much black jade. The publicity the press has given Wyoming jade (all produced from float) has attracted a number of outside prospectors to the State. The largest boulders yet found were located during 1945.

There are three professional and half a dozen amateur cutters at Lander, and the Lander region remains the chief producer. Black nephrite, which takes a fine polish, is being obtained from the Red Desert. Discovery of jade in the Laramie Range is reported. The white "jade" said to have been found near Kemmerer is, according to reliable information, chalcedony. The so-called jade as found is sold at $1 to over $5 a pound. When peace is restored, China, may well become a good market for Wyoming jade. (Personal communications from Fred Abernathy, H. C. Dake, O. W. Plaga, Bert A. Rhoads, and Horace D. Thomas.)

Alaska jade appeared on the market in 1945. The locality, on the north side of Kobuk River, has been well-known to the local Eskimos and Indians since the Thule stage of Eskimo culture (A. D. 600 to 1600).[1] Late in 1945 the Arctic Exploration Co. of Fairbanks located mining claims in the district and flew a considerable shipment of jade to Fairbanks. Some of the material is stated to be of gem quality, but most is fit only for objets d'art. The Chinese have purchased some of it. It is reported that three or four men were collecting boulders from the bed of Kobuk River last summer. The better Alaskan material compares favorably with the better New Zealand nephrite. It is suitable for tourist jewelry and objets d'art.

Turquoise is occasionally found at the Castle Dome copper mine in Arizona. It is "high-graded" by the miners and sold in Miami or Globe. Some of it is of fine quality. A company official states—

> As in the past, turquoise of an undetermined amount was recovered during routine mining operations. As a whole, the quality of the material recovered at greater depth has improved, both in hardness and in color, the latter occurring in the lighter shades of blue.

Turquoise mining was relatively active in Nevada, particularly in the Tonopah and Battle Mountain districts. Most of the material is shipped to New Mexico, although some is cut locally, there being five cutting shops at Battle Mountain (personal communication, Jay A. Carpenter). Alfred L. Ransome states that the lessors, Lee Hand

[1] Ball, Sydney, H., The Mining of Gems and Ornamental Stones by American Indians: Bureau Am. Ethnol., Anthropol. Paper 13, 1941, p. 37.

and Paul Bare, of the Pedro claim on the Copper Basin property of the Copper Canyon Mining Co., Battle Mountain, produced 3,601 pounds of cobbed turquoise in 1945. The Elko County mines appear to have made no shipments in 1945.

In Colorado the King mine, now renamed the Lickspittle, was operated in 1945 by Charles King of Manassa, Colo. Twelve men were employed. The Hall mine, near Villagrove, Saguache County, will soon be operated again. There are rumors of a new turquoise deposit in the Cripple Creek district. New Mexico produced no turquoise, although Indians sorted some material from the dumps. Stuart A. Northrop states that the Indian jewelers are using chrysocolla, malachite, and chalcedony, largely from Arizona, as substitutes for turquoise. Reports indicate intermittent work on the turquoise deposit near Van Horn, Tex.

The agate deposits on the Priday property in Jefferson County, Oreg., a large producer by hand methods, are to be operated mechanically in the future (personal communication from Dr. H. C. Dake). The moss agate deposits of Yellowstone River in Montana, long productive, are said to have produced less than usual in 1945. The easily accessible material is exhausted. Philip S. Hoyt produced some chalcedony in New Mexico and Arizona, which, after staining, is set in costume jewelry. Considerable rose quartz was produced in South Dakota, but most of it (which was poor quality) was sold to decorate rock gardens. Some fine rose quartz was found at the Bon Ami workings at Plumbago Mountain, Newry, Maine, according to Stanley I. Perham.

Utah produced less variscite in 1945 than in the recent past. Junius J. Hayes reports that the Clay Canyon deposit (Utah County) produced about 1,000 pounds; that the Amatrice Hill deposit near Grantsville (Tooele County), although not regularly worked, produced about 200 pounds; and that the Lucin deposit (Box Elder County) probably was not worked.

No sapphires were produced during the year in Montana; as Dr. Francis A. Thomson explains, they have lost their commercial market to the synthetic stones. A little ruby and sapphire were reported to have been produced in Franklin and Clay Counties, N. C. Charles E. Hunter reports that Linten B. Greene procured a fine sapphire at the Corundum Hill mine, Macon County. It is a deep-blue tabular crystal ½ inch thick and 1 inch across. He intends to keep it in his collection as a rough crystal.

Dr. A. M. Butler reports that a considerable amount of "marekanite" (black obsidian nodules in Arizona perlite beds) is being cut cabochon and set in "Indian" silver jewelry. The Superior district south of Queen Creek is the most important locality.

Eldred D. Wilson (Arizona Bureau of Mines Bull. 152, Tucson, Ariz., October 1944) estimates the production value of precious stones in Arizona from 1900 to 1921 at $300,000, an average of $13,636 a year. In recent years production has been much less. Wilson lists the precious stones found in the State, apparently in order of production, as follows: Turquoise, silicified wood, oxidized-copper minerals (azurite, malachite, and chrysocolla), garnet, peridot, Mexican onyx, opal, tourmaline, and obsidian; and, of less importance, rock crystal,

717372—47——98

amethyst, chrysoprase, agate, dumortierite, and catlinite. Small pyrope garnets and peridot are collected by Navajo Indians, the former from Garnet Ridge and Buell Park in Apache County and the latter from the same localities and from west of San Carlos, Gila County. At the latter locality, peridots of over 233-carat weight have been found.

Deep blue dumortierite resembling lapis lazuli occurs as boulders in gravel along the Colorado River 30 miles north of Yuma.

Mrs. E. M. Roe states that only one Sioux Indian mined catlinite at Pipestone, Minn., in 1945 but that a number of returned Indian servicemen expect to dig catlinite and fabricate it.

When the test atom bomb was dropped in New Mexico, the sand near the crater, according to the press, was fused to a grayish green glass. It was dubbed "atomsite," and souvenirs are said to have been made from it.

The States and Territory leading in gem production in 1945 were Wyoming, Oregon, Alaska, Nevada, Utah, and Arizona.

Other gem stones produced in small amounts in 1945 include agate (Idaho, Wyoming, and Luna and Sierra Counties, N. Mex.); amazonite (Amelia, Va.); amethyst (North Carolina and Mineral Valley, Millard County, Utah); aquamarine (Mitchell, Yancey, Avery, Macon, and Ashe Counties, N. C.); asteriated rose quartz (Newry, Maine); chalcedony (Nevada); citrine (North Carolina); emerald (Mitchell and Yancey Counties, N. C.); garnet and golden beryl (Mitchell County, N. C.); jasper (Idaho and near Hot Springs, N. Mex.); moonstone (New Mexico and Mitchell County, N. C.); moss agate (Wyoming); opal (Idaho and Virgin Valley, Nev.); opalized wood (Nevada and New Mexico); rock crystal (Hot Springs district, Ark.); sapphire (Idaho); green smithsonite (Magdalena, N. Mex.), and smoky quartz (North Rumford, Maine).

Heizer and Treganza have written an interesting article on the California Indian Mines and Quarries (see Bibliography). They list 142 sites worked by the Indians for various stones. Turquoise, quartz crystal, chrysocolla, chrysoprase, tourmaline, and malachite were among the gem materials used. They found that the San Bernardino County turquoise mines were worked by the Pueblos of New Mexico and Arizona, who made periodic trips to the mines.

CANADIAN GEM STONES

Canada apparently produced no precious stones in 1945, but a number of amateur lapidaries, particularly near Toronto, cut such Canadian rough as they could get. G. G. Waite,[2] an amateur lapidary, lists a large number of Canadian precious stones suitable for cutting; few, if any, of them are of commercial importance. Some of the Thunder Bay amethyst, however, is of fine color.

ACCESSIONS TO MUSEUMS

The National Museum, Washington, D. C., has added several fine gems to its collection, notably an unusually large and fine green chrysoberyl (120.45 carats) from Ceylon and a zincite (5.12 carats)

[2] Waite, G. G., Contributions to Canadian Mineralogy: University of Toronto, No. 49, 1944, pp. 75-78.

from Franklin, N. J. During the year the American Museum of Natural History acquired a 16-carat cut zincite and a 19-carat oval-cut brazilianite. The latter gem is of pleasing lemon-yellow color and quite brilliant, although it is so soft that it is suitable only for mounting as a pendant. The University of South Carolina recently acquired the Colburn mineral collection of Southern Appalachian gem stones, comprising notably representative specimens of hiddenite, rhodolite, and emerald.

During the year, the well-known star sapphire, The Star of Artaban (300 carats), was presented to the National Museum in Washington.

NOMENCLATURE

The Precious Stone Dealers Association of New York on October 11, 1945, adopted preferred names for gem stones.[3] The use of a geographic designation ("Burma sapphire," for instance) for precious stones similar to the normal type produced by the country named, even if the stone may come from another country thousands of miles away, is highly recommended. It is poor practice, however, to name any member of the quartz family "topaz"; the proper name for yellow or brownish rock crystal is "citrine" or less acceptably "topaz quartz." Even the latter term is incorrect and undesirable. The association attempts in its nomenclature to draw a sharp line between natural and treated stones. The nomenclature committee consisted of H. N. Paskow (chairman), Leo Nathan, and Thomas H. Benedict.

EDUCATION IN GEM STONES

GI's are now permitted, as an educational benefit for service rendered, to enroll in the courses of the Gemological Institute of America. Gem courses in American institutions of learning apparently have a record number of students. The Australian Gemological Association has been formed to advance the knowledge of gem stones in that continent.

The Gem Trade Laboratories, Inc. (36 W. 47th St., New York City), sponsored by the colored-stone and pearl merchants of the city, now identifies stones and will make tests of them on a commercial basis. Dr. A. E. Alexander is in charge.

A new film, The Magic Stone, publicizes the diamond.

IMPORTS

The value of imports of precious and semiprecious real and imitation stones, exclusive of industrial diamonds, as listed by the United States Department of Commerce, totaled $114,435,231, 48 percent more than in 1944. The great gains were in polished diamonds and in cut stones of other types, both natural and synthetic. The figures for imports follow.

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[3] Jewelers' Circular-Keystone, National Jewelers: November 1945, p. 214.

Precious and semiprecious stones (exclusive of industrial diamonds) imported for consumption in the United States, 1944–45

Commodity	1944		1945	
	Carats	Value	Carats	Value
Diamonds:				
Rough or uncut (suitable for cutting into gem stones), duty free	896,547	$43,445,219	893,761	$43,122,622
Cut but unset, suitable for jewelry, dutiable	169,097	29,263,121	377,243	64,185,406
Emeralds:				
Rough or uncut, free	1,966	1,668	1,085	252
Cut but not set, dutiable	38,666	81,233	106,684	181,834
Pearls and parts, not strung or set, dutiable:				
Natural		242,221		352,947
Cultured or cultivated		15,394		155,548
Other precious and semiprecious stones:				
Rough or uncut, free		105,401		134,698
Cut but not set, dutiable		3,725,453		5,113,937
Imitation, except opaque, dutiable:				
Not cut or faceted		14,550		3,220
Cut or faceted:				
Synthetic		503,718		805,838
Other		23,887		242,988
Imitation, opaque, including imitation pearls, dutiable		23,113		31,136
Marcasites, dutiable:				
Real		84,828		101,140
Imitation				3,665
		77,529,806		114,435,231

GOVERNMENT REGULATIONS

The end of the war has not diminished greatly the number of Government regulations affecting trade in precious stones.

In the United States, the OPA relinquished price control on "synthetic and semiprecious stones for jewelry purposes" on October 15, 1945. On December 27, the United States Government liberalized the export of jewelry, including that containing diamonds, but has refused to reduce the excise tax (20 percent) on jewelry sales, an element that encourages a black market in the jewelry trade. Canada early in the year removed price controls on jewelry.

As a postwar measure, during the year Australia permitted the import and export of jewelry. On October 21, 1945, Mexico removed the export duty on silver jewelry, even if set with stones of local origin; and Argentina, as of May 4, unified at 5 percent its sales tax on jewelry. In the fall Mexico imposed a 3-percent sales tax on jewelry. As of October 1945, South Africa still required export permits for gold and diamond jewelry. Late in the year the Italian Government removed the ban on trade in precious metals and gems.

To protect its mines and its cutters of precious stones, Brazil (January 22, 1945) required import licenses for all precious stones, diamonds, and quartz crystals; after May 25, 1945, upon presentation of import licenses, 1 unit of cut synthetic gems could be imported, provided at the same time 10 units of rough synthetic gems were imported.

In Uruguay the sales tax (February 23, 1945) on jewelry became 13 percent. On March 31, 1945, France increased the luxury tax on jewelry sales from 10 to 25 percent, and late in the year Bolivia increased the luxury tax to a point that threatens the disappearance of jewelry from the retailers' shelves in that country.

As to taxes, the Quebec jewelers find themselves in what would be a ludicrous position, were it not serious. Their sales are subject to a 25-percent Federal tax, a 6-percent Provincial tax, and a 2-percent municipal tax.

DIAMOND

Nineteen forty-five was a highly prosperous year in the diamond industry. The sales of the Diamond Trading Co., the principal seller of rough stones, reached £24,500,000—an all-time peak; presumably, the sales of cut goods also attained a record. Indeed, the United States imports of cut were appreciably above those of the lush 1920's. Again consumption greatly exceeded production, and the drain on stocks was heavy. Stocks in certain categories of both rough and cut are depleted, and in no grade are they large. In consequence, both the gem and industrial diamond trades must look more and more to current production for their diamonds. Additional mines are being equipped, but no great increase in production can be expected for 3 or 4 years.

World production was almost 14,000,000 carats, a fifth greater than that of 1944. Of the total, 83 percent by weight were industrials and 17 percent gem grades.

The price of gem rough again advanced, although there has been no increase in the wholesale price of industrials in 7 or 8 years. Uncut gem diamonds are now quoted at more than twice the prewar price. Cut has never been so high. Since 1939, melee has at least tripled in price, and larger cut has more than doubled in price. The price of large stones (10 carats or more) is a matter of negotiation between buyer and seller. Fine cut, in the United States at least, was in short supply much of the year.

Industrials, once a drug on the market, now represent about 20 percent, in dollar value, of the world's rough sales. Yearly the distinction between gem grades and industrials is defined more sharply.

With the war's end, investment in diamonds has not ceased. The people of much of the world have more confidence in diamonds than in their own countries' currency.

Share dealings.—The shares of diamond-mining companies, virtually all of which are listed on the London Stock Exchange, gained about 17 percent in 1945 as contrasted with the slight loss suffered in 1944. Strangely enough, quotations were affected only slightly by the surrender of Germany and Japan, but much more so by sales of rough, dividend declarations, and publication of annual reports. Of the eight principal mining companies, all paid dividends in 1945, although the yield at year-end prices varied greatly.

Imports.—Imports of gem diamonds into the United States increased from $26,186,948 in 1942 to $107,308,028 in 1945, or almost 310 percent.

The following table shows comparative figures of imports during 1944 and 1945. The figures for rough are almost identical; those for cut show an increase, respectively, of 123 percent by weight and 119 percent by value. The grade of the imports was somewhat poorer in 1945 than in 1944.

Diamonds imported into the United States, 1944–45, by countries

[Exclusive of industrial diamonds]

Country	Rough or uncut			Cut but unset		
	Carats	Value		Carats	Value	
		Total	Average		Total	Average
1944						
Africa:						
British:						
Gambia and Sierra Leone	725	$13,164	$18.16			
Gold Coast	1,350	24,860	18.41			
Union of South Africa	854,239	42,197,278	49.40	32,676	$6,514,128	$199.36
Australia				1	500	500.00
Belgium and Luxembourg	(1)	5	5.00	641	137,063	213.83
Brazil	25,619	726,378	28.35	25,031	4,219,310	168.56
British Guiana	2,613	64,405	24.65	532	61,162	114.97
Cuba				43,683	6,749,686	154.52
Mexico				1,092	30,738	28.15
Netherlands				20	11,423	571.15
Palestine and Trans-Jordan				53,883	9,337,281	173.29
U. S. S. R				1,436	202,180	140.79
United Kingdom	6,201	233,977	37.73	10,102	1,999,650	197.95
Venezuela	5,800	185,152	31.92			
	896,547	43,445,219	48.46	169,097	29,263,121	173.06
1945						
Africa:						
British:						
British East Africa	7,413	207,556	28.00			
British West Africa [2]	1,158	21,402	18.48			
Union of South Africa	834,393	41,290,329	49.49	46,096	10,720,816	232.58
Argentina				4	2,000	500.00
Austria				12	1,136	94.67
Belgian Congo	10,054	86,793	8.63			
Belgium and Luxembourg				104,840	14,612,123	139.38
Brazil	14,349	628,325	43.79	28,472	4,988,200	175.20
British Guiana	1,774	42,715	24.08	580	67,471	116.33
Canada	1,110	16,650	15.00	1	100	100.00
Cuba				64,737	11,439,698	176.71
France				44	7,511	170.70
Germany				1,230	133,496	108.53
India and Dependencies				703	134,641	191.52
Mexico	13,838	504,641	36.47	9	5,003	555.89
Netherlands				2,599	520,516	200.28
Palestine and Trans-Jordan				105,899	17,684,997	167.00
Portugal				18	6,405	355.83
Switzerland				271	39,738	146.63
U. S. S. R				3,569	562,617	157.64
United Kingdom	5,699	173,797	30.50	17,535	3,176,270	181.14
Venezuela	3,973	150,414	37.86	624	82,668	132.48
	893,761	43,122,622	48.25	377,243	64,185,406	170.14

[1] Less than 1 carat.
[2] Effective Jan. 1, 1945, includes Gambia and Sierra Leone.

Cutting.—Due largely to revival of part of the Belgian cutting industry, the number of artisans employed jumped from 14,000 at the end of 1944 to 25,000 at the end of 1945. The amount of rough gem material has not been increased proportionately; and, because of shortages of rough, there will presumably be considerable unemployment in the trade in 1946. The best cutting of large stones today is done in the United States and the finest small cut in the United

States, Palestine, and Belgium. The Belgian industry has made a remarkable come-back and at the year end had 10,000 operatives. The other principal cutting centers are New York City, Palestine, Brazil, and Holland.

World production.—Owing to the war, accurate diamond-production statistics are not available, but the estimates in the following table are believed to be fairly reliable. World production (gems and industrials) in 1945 is estimated to have been 14,257,000 carats (3.129 short tons), worth about $64,750,000. The quantity was about 22 percent greater and the value 35 percent greater than in 1944. Of the total, cuttables made up about 18 percent of the total, a smaller proportion than last year because of the large production of crushing bort by BCK, a Belgian Congo producer. By weight, some 5,125 pounds were industrials and 1,130 pounds gem stones.

The Belgian Congo was the leading producer by weight (72.9 percent), although it represented but 13 percent of the value. On the other hand, the British Empire, accounting for only 19.2 percent of the weight, represented 71 percent of the value.

Compared with 1944, the Belgian Congo increased its production, by weight, 38 percent. Tanganyika Territory continued its gain in output; in consequence, DeBeers sent engineers to look over the field. DeBeers operated its Dutoitspan and Bulfontein pipe mines and is beginning to reopen Premier and New Jagersfontein, although it will be several years before these are producing. The South African alluvial production increased. The Venezuelan production continued to decrease, and that of Brazil probably was less than in 1944.

The following table shows as accurately as available statistics permit world production for the past 5 years.

World production of diamonds, 1941–45, by countries, in metric carats

[Including industrial diamonds]

Country	1941	1942	1943	1944	1945
Africa:					
Angola	786, 980	791, 850	794, 990	800, 000	786, 000
Belgian Congo	5, 866, 000	6, 018, 236	4, 881, 000	7, 540, 000	10, 386, 000
French Equatorial Africa	[1] 30, 000	[1] 20, 000	[1] 20, 000	[1] 5, 000	[1] 5, 000
French West Africa	57, 726	1, 500	[1] 35, 000	[1] 60, 000	[1] 60, 000
Gold Coast	[1] 1, 000, 000	[1] 1, 000, 000	[1] 1, 000, 000	[1] 1, 000, 000	[1] 500, 000
Sierra Leone	[1] 850, 000	[1] 850, 000	[1] 850, 000	[1] 700, 000	[1] 800, 000
South-West Africa	46, 578	56, 420	[1] 88, 000	154, 000	156, 000
Tanganyika	29, 046	41, 000	52, 998	90, 667	115, 666
Union of South Africa:					
Mines			175, 885	639, 000	878, 713
Alluvial	158, 422	118, 821	126, 444	270, 000	262, 527
Total Union of South Africa	158, 422	118, 821	302, 329	909, 000	1, 141, 240
Brazil	[1] 325, 000	[1] 300, 000	[1] 275, 000	[1] 370, 000	[1] 275, 000
British Guiana	26, 427	22, 208	18, 272	13, 911	17, 251
Other countries	34, 350	40, 836	29, 650	34, 000	[2] 15, 000
Grand total	9, 210, 529	9, 260, 871	8, 347, 239	11, 676, 578	14, 257, 157

[1] Estimated.
[2] Includes Venezuela (12,769 carats), Borneo, India, New South Wales, and U. S. S. R.

Industrial diamonds.—With the end of World War II, it was expected that imports (roughly, consumption) would fall markedly. Many war contracts were canceled after VJ-day but imports, as to weight, held up surprisingly, although the drastic decline in value indicates that crushing bort formed an ever-increasing percentage of American imports. Consumption again largely exceeded production, and stocks were heavily drawn on and are perhaps dangerously low; certainly, they are largely depleted as to some sizes and grades. Manufacturers of diamond-set tools have, through inertia, demanded of the trade a type of diamonds that may be in short supply. Provided they show ingenuity in using diamonds physically more or less similar, they will find a fair stock at their disposal. American industrial diamond merchants probably have a relatively large stock.

Thanks to the large production of BCK, the 1945 output of industrials was an all-time record, but much of it was crushing bort, and no great increase in the production of bort can be expected for 2 or 3 years.

After VJ-day, the United States Government removed many of its controls over industrial diamonds, although import and inventory controls are still in effect. The British Government removed all controls in the Empire in December.

Diamond drilling was exceedingly active in 1945 due to the mining boom in Canada and the increasing use of diamond bits in stope drilling. Diamond consumption in drilling increased greatly. Diamond-impregnated wheels—the bond being a plastic, a ceramic product, or a powdered metal—are having wide peacetime use. Standardization of diamond powders has been accepted by the industry. War-born uses for diamond tools and dies insure a satisfactory peacetime demand.

Figure 1, originally prepared by Herbert Backman several years ago, shows the tremendous increase in use and the sharp decline in price per carat in American imports in the last 27 years.

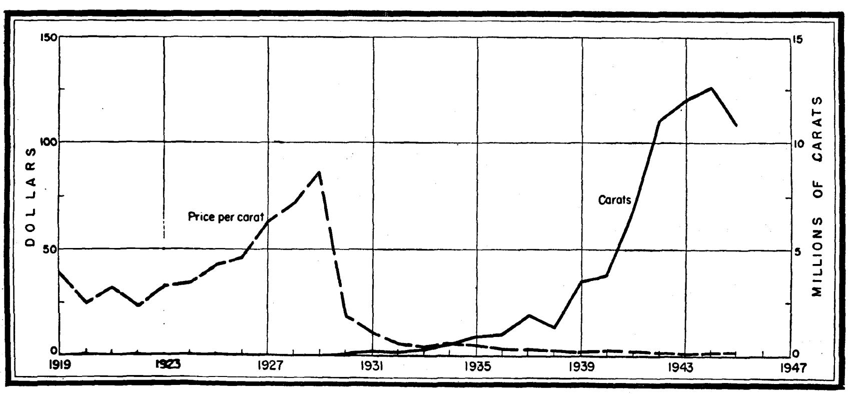

FIGURE 1.—United States imports and average price per carat of industrial diamonds, 1919–45.

Imports of industrial diamonds into the United States during the past 5 years were as follows:

Industrial diamonds (glaziers', engravers', and miners') imported for consumption in the United States, 1941–45

Year	Carats	Value		Year	Carats	Value	
		Total	Average			Total	Average
1941	6,882,248	$14,908,809	$2.17	1944	12,614,507	$22,861,401	$1.81
1942	11,203,704	22,057,577	1.97	1945	10,729,869	12,810,932	1.19
1943	12,084,133	21,890,568	1.81				

RUBY, SAPPHIRE, AND EMERALD

Of the world's purchases of precious stones, at least 95 percent are diamonds. Because of this and because the types of the deposits of the ruby, sapphire, and emerald do not lend themselves to large-scale operations, successful gem mining by large companies is confined to the diamond. It is true that Burma Ruby Mines, Ltd., for over 3 decades worked the Burmese ruby mines and that several entrepreneurs have leased and worked the Colombian emerald mines, but such enterprises were failures. Fine rubies come from Burma; gem sapphires from Thailand, Indochina, Kashmir, and Ceylon; and emeralds from Colombia and the Urals in Russia. In the first half of 1945, the United States imported from Russia 1,682 carats of cut emeralds valued at some $31,000, or roughly $18.50 a carat. The price suggests that the quality was poor. Today some of these deposits are shut down; Indochina and Kashmir are practically exhausted, or at least it is so reported; the Colombian emerald deposits are dormant; and during World War II the Ceylonese gem miners were recruited to mine graphite. Furthermore, the colonial laws made the marketing of gems complicated, if not almost impossible. Shipments from Ceylon to America are inferior to prewar shipments. The Ceylonese have more money than formerly to buy fine gems, and they have lost their European markets for inferior gems. The native miners of Burma, Thailand and Indochina in 1945 continued to mine a few gems, although they could scarcely have sold many to the Japanese. Happily, the Burma ruby mines were reoccupied by the United Nations on March 20, 1945, and Thailand and Indochina later.

In consequence of the above circumstances, very few newly mined colored gems are coming on the market, and today we look to jewelers' stocks and old jewelry for our supply. Some fine emeralds are being obtained from once-wealthy nationals of Spain and England, and rubies and sapphires from the out-moded jewelry of England and the Continent. The demand is insistent, but the supply is inadequate. Although prices today are very high, they are likely to follow the law of supply and demand and go higher.

Fine rubies, sapphires, and emeralds of size are hard to find in New York today and are by no means modestly priced. The New York market must also compete with the Far Eastern market, where colored stones are highly regarded, not alone for their beauty, but also as the safest of investments. Compared with the diamond the noble gems, particularly the emerald, have a more restricted group of admirers, although these may well be the more intelligent and intellectual of the populace. The diamond, therefore, has a higher rank as an investment.

At present, demand and supply are badly out of balance and will be in the immediate future, unless demand becomes less insistent.

Our soldiers in the East continue to buy gems, and as amateurs they are commonly duped with synthetic or inferior gems. At times, however, they may pick up lucky bargains. Their purchases have forced up prices appreciably.

It has been noted that colored glass used to direct traffic on American airfields in Burma disappeared; it is a possible source of some of the "gems" the boys are buying. The members of the American Gem Society have offered to test free for veterans the stones they have purchased.

The Muzo and Coscuez emerald mines in Colombia have been shut down since 1938. The Colombian Government desires to turn the ownership of these mines from a liability into an asset. The emeralds in the Bank of the Republic owned by the Government, valued by Modero and Dixon at pesos 1,200,459.26, were said to have been sold early in 1946 to an American jewelry firm for some $685,000 United States currency.

LESSER GEMS

In America the opal has been used more in fine jewelry in the past year than for several generations; and our armed forces, when stationed in Australia, bought many fine gems. The stone's beauty deservedly warrants its revived popularity. During the war few Australian opals were produced, and the Mexican production has been small, hence the price trend of all grades is upward.

A new gem stone of considerable beauty, brazilianite, was discovered during the year. Zincite of an attractive deep-red color, from Franklin, N. J., has recently been cut into gems. Reference has been made to both of these gems in the section on Accessions to Museums and in the bibliography.

The aquamarine remains one of the most popular gem stones, so popular, in fact, that blue topaz, which if fine in quality is a superior stone, is appearing on the market as a substitute. Price has moved up markedly, apparently to an unwarranted extent. Brazil is the premier producer, particularly Minas Gerais and to a lesser extent Ceará. Minas Gerais includes the production of aquamarine with tourmaline. In 1936 over 7,235,000 carats of the two gems were produced; since then production has fallen and in 1943 was only 1,469,000 carats. Exports of aquamarine to the United States, however, have increased considerably—in 1943 158,695 carats valued at about $232,000 ($1.46 per carat) and in 1944, 364,285 carats valued at $578,506 ($1.58 per carat). Brazil also produces a much smaller amount of kunzite, a few emeralds, a little topaz, fine garnets, and much rock crystal and citrine.[4] Brazil stains a certain amount of chalcedony to black onyx, some of the product being exported.

[4] See also Pough, Frederick H., Jewelers' Circular-Keystone, February 1945, pp. 143–144, 158–163.

The Madagascar gem-mining industry, which was negligible during the war, may revive, as certain French firms wish to import rough gem stones.

The gem production of Ceylon during the war was small, labor being diverted to more important industries.

South African jewelry manufacturers are attempting to interest the public in the Dominion's rather mediocre gem stones, the diamond of course, being the exception.

It is reported that production at the Nishapur (Iran) turquoise mine has been very small during the past few years (personal communication from Lester S. Thompson). Lithuania is again beginning to produce and fabricate amber. Meerschaum was one of the principal exports of Turkey before the war; to a certain extent the industry is reviving (1944 production, 9,520 kilograms).

Asteriated quartz colored blue is being offered on the market as a substitute for the star sapphire.

BIBLIOGRAPHY

Ball, Sydney H. The Diamond Industry in 1945. Jewelers' Circular-Keystone, N. Y., 1946, 24 pp.

——— Gem Myths Common to the Peoples of Eastern Asia and the American Indians. Gems and Gemology, Los Angeles, Calif., vol. 5, 1945, pp. 218–221.

Gordon, Samuel G. The Inspection and Grading of Quartz. Am. Mineral., vol. 30, 1945, pp. 269–290.

Grodzinski, Paul. Diamond Tools. Anton Smit & Co., New York, 1944.

Heizer, Robert F., and Treganza, Adam E. Mines and Quarries of the Indians of California. California Jour. Mines and Geol., July 1944, pp. 291–359.

Henderson, E. P. Zincite. Gems and Gemology, Fall 1945, pp. 251, 256.

Jewelers' Circular-Keystone, The Jewelers Dictionary. New York, 1945, 272 pp.

McCarthy, James Remington. Rings through the Ages. Harper & Bros., New York, 1945, 202 pp.

Parish, William, and Gordon, Samuels G. Oscillator Plates, A Symposium. Am. Mineral., vol. 30, 1945, pp. 246–415.

Pfund, A. H. The Identification of Gems. Jewelers' Circular-Keystone, November 1945, pp. 242, 244, 284, 286. (Reprinted from Journal of the Optical Society of America.)

Pough, Frederick H., and Henderson, Edward P. Brazilianite a New Phosphate Mineral. Am. Mineral., vol. 30, 1945, pp. 572–582.

Shipley, Robert M. Dictionary of Gems and Gemology. Los Angeles and Boston, 1945, 254 pp.

Shore, Sidney X. How Quartz Crystals are Manufactured. North American Philips Co., Inc., New York, 1945, 38 pp.

Webster, Robert (revised by V. V. Hinton). Introductory Gemology. Gemological Inst. America, Los Angeles, Calif., 1945, 181 pp.

Wilson, Eldred D. Arizona Nonmetallics. Arizona Bureau of Mines Bull. 152, 1944, pp. 6, 37–38.

Weinstein, Michael. Precious and Semiprecious Stones. Isaac Pitman & Co. Ltd., London, 4th ed., 1944, 185 pp.

NITROGEN COMPOUNDS

By Bertrand L. Johnson[1]

SUMMARY OUTLINE

GENERAL CONDITIONS

War, with its insistent call for nitrogen for munitions and the concomitant increased nitrogen requirements of an intensified agriculture and industry, demands immense supplies of this element. World War II, the greatest of all wars, created correspondingly large needs for nitrogen, far in excess of the capacity of domestic plants at the start of the war. Erection of many new synthetic nitrogen plants boosted the productive capacity, and domestic output of nitrogen reached new peaks. Rising from only 450,000 tons in 1939, it exceeded 1,250,000 tons annually in the final years of the war.[2] During the war agricultural and industrial consumption of nitrogen doubled, and military consumption rose from 59,000 short tons in 1941 to nearly 600,000 tons a year at the close.

The conclusion of major hostilities in 1945 was followed by collapse of the military demand for nitrogen for munitions, closing of several Government-owned synthetic nitrogen plants, and diversion of the

Salient statistics on nitrogen compounds produced in the United States, 1944–45, in short tons

	1944	1945
Ammonia (NH_3):		
Synthetic plants: Anhydrous ammonia [1]	541,079	548,655
Byproduct coking plants:		
Aqua ammonia (NH_3 content)	31,665	27,607
NH_3 content of ammonium sulfate	204,561	191,073
NH_3 equivalent all forms	236,226	218,680
Ammonium sulfate:		
Synthetic plants	88,000	(2)
Byproduct coking plants	818,244	764,293
Sodium nitrate: Total synthetic and byproduct plants	(2)	(2)

[1] Data from monthly Facts for Industry series: U. S. Department of Commerce, Bureau of Census; Civilian Production Administration; and War Production Board.
[2] Figures not available.

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.
[2] Surplus Property Administration, Chemical Plants and Facilities: Rept. to Congress Nov. 12, 1945, 80 pp.

product from other plants to agricultural instead of military uses. The shift from war to peacetime conditions in the nitrogen industry is still in progress, hampered by industrial uncertainties and complicated by the sudden increased demand from famine-threatened countries for nitrogenous fertilizers.

Salient statistics on nitrogen compounds imported into and exported from the United States, 1943–45, in short tons

	1943	1944	1945
Imports:			
Industrial chemicals:			
Anhydrous ammonia	5,863		4
Ammonium nitrate	53,256	(1)	(1)
Fertilizer materials:			
Ammonium sulfate	99,827	103,628	118,890
Calcium cyanamide	125,634	101,886	141,057
Ammonium nitrate mixtures containing 20 percent or more nitrogen	2,895	317	655
Nitrogenous materials, n. s. p. f.	63,372	112,521	135,010
Ammonium phosphates	43,987	91,943	92,757
Sodium nitrate	761,165	712,434	849,888
Sodium-potassium nitrate	19,767	9,407	
Exports:			
Industrial chemicals:			
Anhydrous ammonia	1,983	3,623	4,312
Aqua ammonia	6,812	2,499	2,715
Ammonium nitrate	9,534	13,454	9,845
Fertilizer materials:			
Ammonium sulfate	78,005	10,615	20,752
Calcium cyanamide		(1)	(1)
Nitrogenous chemical materials, n. e. s.	13,215	11,175	83,974
Sodium nitrate	6,740	11,435	12,229

[1] Less than 1 ton.

OUTLOOK

The reconversion period following World War II finds the United States with a tremendous domestic nitrogen productive capacity of 1,500,000 to 1,700,000 short tons of nitrogen annually, which, combined with annual net imports of 200,000 to 300,000 tons, could make available supplies of 1,700,000 to 2,000,000 tons of nitrogen a year. This capacity is more than double prewar domestic consumption and greatly exceeds present needs, which the most favorable estimates place at less than 1,200,000 tons. The domestic plant capacity is enough to make the United States more than self-sufficient in nitrogen, except where cyanamide from Canada and natural nitrates from Chile are specifically demanded. As the combination of existing privately owned plants and imports does not appear to be able to meet domestic demands, except under depression conditions, some supplies from the Government-owned fixed-nitrogen plants are deemed necessary. Many of these Government-owned plants have been declared surplus, and their ultimate disposal is uncertain.

The total consumption of nitrogen in the immediate future is expected to be considerably less than that reached during the war. Munition requirements are expected to be relatively small. Industrial consumption, at a peak of over 300,000 tons in 1943–44, decreased slightly in 1944–45 and may decline much further under unfavorable industrial conditions. The demand for fertilizer nitrogen will probably continue at a high level, at least for a year or two, because of the world-wide food shortage.

The prospective nitrogen situation is discussed in considerable detail in a recent report of the Surplus Property Administration.[3]

INORGANIC NITROGEN COMPOUNDS

NATURAL NITRATES

Domestic nitrate deposits.—None of the deposits of soluble nitrate minerals scattered throughout the United States have yet proved of sufficient size or grade to serve as a basis for a domestic nitrate industry. Consequently, little attention has been paid to them in recent years, and none of the deposits is known to have been under investigation or development in 1945. Many have been described. The published reports are cited in the Nitrogen Compounds chapter, Minerals Yearbook, 1942, page 1522.

Chilean nitrate.—Large quantities of natural sodium nitrate continue to be imported from Chile. Imports in 1945 were much larger than in 1944. No sodium-potassium nitrate was imported in 1945, however, although several thousand tons a year usually enter the United States from Chile. These imports in recent calendar years are shown in the accompanying tables. Imports in 1946 are expected to be much smaller than in 1945 because increased quantities have been diverted to European markets and the supply available for the United States has decreased in consequence. Even with an expected increase of domestically produced synthetic sodium nitrate, it is reported that the total amount of foreign and domestic supplies of sodium nitrate available for agriculture in the crop year 1945–46 probably will not exceed 75 percent of the tonnage delivered to agriculture in the season of 1944–45 in the States east of the Rocky Mountains.

Sodium nitrate imported for consumption in the United States, 1941–45

Year	Chile		Total		Year	Chile		Total	
	Short tons	Value	Short tons	Value		Short tons	Value	Short tons	Value
1941	610, 561	$10,868,222	610, 569	$10, 868, 568	1944	712, 434	$15,304,946	712, 434	$15,304,946
1942	899, 090	17,180,780	899, 150	17, 183, 425	1945	849, 888	18,558,959	849, 888	18,558,959
1943	761, 165	15,188,787	761, 165	15, 188, 787					

Sodium-potassium nitrate (all from Chile) imported for consumption in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	34, 541	$725, 846	1944	9, 407	$278, 534
1942	14, 272	377, 703	1945		
1943	19, 767	580, 760			

During the war, in order to maintain the movement of sodium nitrate from Chile and to sell the product below the ceiling of the Office of Price Administration, a wartime subsidy ranging upward

[3] Surplus Property Administration, Chemical Plants and Facilities: Washington, D. C., 1945, 80 pp. Progress in Disposal of Synthetic Ammonia and Alcohol Plants: Suppl. 3, 1945, 8 pp.

to about $7 a ton was paid; the United States Government thereby absorbed some of the increased production and shipping costs. This practice, however, is reported to have been discontinued in July 1945.

During the first 9 months of 1945 imported sodium nitrate was allocated under Schedule 80 (Nitrogen Compounds) of WPB General Allocation Order M–300 which governed the distribution of nitrogen compounds. With easing of wartime restrictions on business, this order was revoked, as of September 30, 1945; and imported sodium nitrate, with the other "nitrogen compounds", was removed from allocation. Allocation had been necessary because of the insufficiency of the supply of sodium nitrate for full agricultural requirements. Its use in the United States east of the Rocky Mountains was restricted to direct application to the soil as side and top dressings. Little was allotted to mixed fertilizers.

Prices of imported sodium nitrate at the wholesale level throughout 1945 were covered by Revised Maximum Price Regulation 205 of June 30, 1944, and amendment 4 to that regulation, effective November 16, 1944. The maximum delivered price at any destination was set at $30 per ton in bulk, $33 in 100-pound bags, or $32.40 in 167- or 200-pound bags, plus the lowest carlot freight rate per ton on the material to the destination from the nitrate port that has the lowest carlot freight rate.

The maximum delivered price at any destination for nitrate of soda-potash (minimum nitrogen content, 14 percent) was fixed at $38 per ton in bulk, $41 in 100-pound bags, or $40.40 in 167- or 200-pound bags, plus the lowest carlot rail freight as defined above.

Amendment 4 permits an increase of 50 cents per ton for imported nitrate of soda loaded on trucks at warehouses in New York, N. Y., Camden, N. J., and Baltimore, Md.

Retail prices of agricultural sodium nitrate were covered by Second Revised Maximum Price Regulation 135 and amendments up to No. 4 (effective November 26, 1945).

Early in 1946 the Federal Trade Commission announced that a monopoly complaint against the Chilean Nitrate Sales Corp. and the Barrett Co., both of New York, charging them with conspiring to monopolize the sale of raw nitrate of soda, had been "dismissed without prejudice."

On April 3, 1945, the State Department announced[4] that, as a result of discussions between the United States and Chilean delegations at the recent Inter-American Conference on Problems of War and Peace at Mexico City, regarding the operation and disposal of synthetic nitrogen plants owned by the Government of the United States—

> The Secretary of State informed the Minister of Foreign Affairs of Chile that it was not the intention of the Government of the United States that the production by the Government of synthetic nitrogen in plants owned by it and constructed for war purposes, should be continued beyond the period necessitated by the conditions or consequences of the war, except as might be necessary in order to maintain the plants in efficient operating condition for national security from the point of view not only of physical condition but also for the purpose of continuing scientific research and technological progress. The Chilean Minister of Foreign Affairs was also informed that should it be necessary for the Government of the United States to modify this position, there would be consultation with the Government of Chile before action was taken.

[4] U. S. Department of State, Press Release 293: Apr. 5, 1945, 1 p. (mim.).

The Secretary of State also informed the Foreign Minister of the intention of the Government of the United States to consult with the Government of Chile with respect to such Government plants for the production of synthetic nitrogen, constructed for war purposes, as might not be dismantled, or converted to uses other than the production of synthetic nitrogen or maintained for national security, if the terms or conditions of cession, sale or lease of such plants to private interests might create serious problems affecting the production or exportation of Chilean nitrates. Such consultation would be for the purpose of reaching such accord with respect to those problems as would, while protecting the interests of the United States Government, give due consideration to the effects upon Chile, particularly from the point of view of the competitive situation created by the terms or conditions of cession, sale, or lease of those plants.

SYNTHETIC NITROGEN COMPOUNDS

General.—The general situation in the synthetic nitrogen industry in the United States in recent years has been covered in the Nitrogen Compounds chapters in Minerals Yearbooks, 1942, 1943, and 1944. This chapter presents the major developments in 1945.

Ammonia and certain other nitrogen compounds were assembled December 26, 1944, under WPB General Allocation Order M–300, Schedules 79 (Synthetic Ammonia) and 80 (Nitrogen Compounds) as appendix B materials. The nitrogen compounds listed under Schedule 80 were ammonium sulfate, sodium nitrate, ammonium nitrate (fertilizer grade), calcium cyanamide, ammonium phosphate (fertilizer grade), ammonium nitrate mixtures, mixed nitrogen solutions, B liquors, urea mixtures of 42 percent nitrogen (including Uramon but not including food-grade urea). On February 7, 1945, Schedule 80 was amended to substitute aqua ammonia (A, B, and C liquors) for B liquor. These schedules governed distribution of the commodities above specified for the first 9 months of 1945 but were then revoked, and the commodities referred to in them were removed from allocation as of September 30, 1945.

Ammonia and its compounds.—Early in 1945, 19 synthetic ammonia plants are said to have been in operation in the United States. These included 10 Government-owned plants—the 8 ordnance plants, and those of the Tennessee Valley Authority and the Defense Plant Corporation—and 9 private companies. Various data regarding the Government-owned plants are provided in the accompanying table. Many other details and the general situation surrounding their disposal are given in a report of the Surplus Property Administration.[5] The greater part of the production of domestic private plants came from 2, owned, respectively, by E. I. du Pont de Nemours & Co. and the Allied Chemical & Dye Corp. These 2 plants have about 90 percent of the total domestic private synthetic ammonia production capacity.

Following cessation of hostilities in 1945 several ordnance plants (Ohio River, Dixie, Buckeye, Jayhawk, Ozark, Cactus, and Morgantown) and the Defense Plant Corporation operation at Lake Charles, La., were declared surplus and were advertised for purchase or lease in September 1945 by the Reconstruction Finance Corporation. Since then the Ozark, Jayhawk, and Buckeye plants are reported to have been leased to commercial operators. Morgantown ordnance and Missouri ordnance are now being held by the Army for military

[5] Surplus Property Administration, Chemical Plants and Facilities: Report to Congress, Nov. 12, 1945, 80 pp. Appendix III, Dec. 5, 1945, 8 pp.

Government-owned synthetic ammonia plants [1]

Name	Location	Sponsor	Annual design rated nitrogen capacity (short tons)	Ultimate nitrogen capacity (short tons)[2]	Operator
Morgantown	Morgantown, W. Va	Ord	216,000	[3]71,000	E. I. du Pont de Nemours & Co.
Ohio River	West Henderson, Ky	Ord	44,000	61,200	Atmospheric Nitrogen Corp.
Missouri	Louisiana, Mo	Ord	44,000	56,600	Hercules Powder Co.
Dixie	Sterlington, La	Ord	44,000	56,900	Commercial Solvents Corp.
Buckeye	South Point, Ohio	Ord	133,000	187,000	Atmospheric Nitrogen Corp.
Jayhawk	Baxter Springs, Kans	Ord	89,000	128,200	Military Chemical Works, Inc.
Ozark	El Dorado, Ark	Ord	89,000	131,200	Lion Chemical Co.
Cactus	Sunray, Tex	Ord	44,000	56,900	Shell Union Oil Co.
Lake Charles	Lake Charles, La	DPC	44,000	56,900	Mathieson Alkali Works, Inc.
Muscle Shoals	Muscle Shoals, Ala	TVA	50,000	56,900	Tennessee Valley Authority.
Total			797,000	862,800	

[1] Available data, Ordnance Department, Oct. 4, 1945. From Surplus Property Administration, Chemical Plants and Facilities.
[2] Actual peak performance in some months has been higher than annual rates for several of the plants, indicating a possible ultimate capacity of 891,200 tons per year.
[3] With only 1 synthesis unit on ammonia.

stand-by. Pending Army need the Missouri plant, near Louisiana, Mo. (less than 100 miles above St. Louis on the Mississippi River), has been taken over by the Bureau of Mines, United States Department of the Interior, for conversion to an experimental synthetic liquid-fuel demonstration operation for the production of synthetic gasoline and oil from coal and lignite, to supplement and conserve the Nation's petroleum reserves. The plans of the Bureau of Mines call for two distinct units, one using the direct hydrogenation method of producing synthetic fuels, and the other employing the indirect gas-synthesis process. All changes are to be so made that the plant may be reconverted to the production of ammonia should another emergency occur.

Part of Nitrate Plant No. 1 of the Tennessee Valley Authority at Muscle Shoals, Ala., has been leased for 10 years to the Reynolds Metal Co., of New York.

The ultimate disposal of the other Government-owned plants is still uncertain.

Production of domestic byproduct-coke ammonia liquor (NH_3 content) was 27,607 short tons compared with 31,665 tons in 1944. Sales were 25,720 tons in 1945 compared with 30,004 tons in 1944.

Ammonium sulfate is one of the principal sources of nitrogen used in mixed fertilizers, and virtually all that is produced goes into fertilizers. Almost the entire production in the United States comes from byproduct-coke ovens, that chemical being the preferred form in which ammonia generated from the distillation of coal is recovered. A small quantity is of synthetic origin. Lower production, greater sales, and decreased stocks characterized the ammonium sulfate industry in 1945. The output of byproduct ammonium sulfate decreased from 818,244 short tons in 1944 to 764,293 tons in 1945, a decline of 53,951 tons, whereas sales increased from 776,962 tons in 1944 to 801,062 tons in 1945. Stocks were cut more than one-half, decreasing from 69,031 tons at the end of 1944 to 32,175 tons at the close of 1945.

Maximum prices of ammonium sulfate at the wholesale level are still fixed by Revised Maximum Price Regulation 205 of June 30, 1944, and later amendments of the Office of Price Administration.

Ammonium nitrate results from neutralization of nitric acid with ammonia. Domestic production before World War II was only a few thousand tons a year, and a large proportion of the domestic consumption was imported. During the war, however, production and consumption in the United States increased greatly, and because of continued shortage from domestic sources large quantities were imported from Canada. Munition requirements had preference, but large quantities were diverted to agricultural use to supplement the inadequate supplies of other inorganic nitrogen materials. Ammonium nitrate is a present and possibly permanent competitor of sodium nitrate and ammonium sulfate, which formerly dominated the business of top-dressing and side-dressing crops.

Domestic production comes from both Government-owned and private plants. Four of the Government's fixed-nitrogen plants have facilities for producing ammonium nitrate solutions; their combined capacity is rated at 55,000 tons of 100-percent ammonium nitrate per month. These plants are the Buckeye Ordnance Works, South Point, Ohio; the Ozark Ordnance Works, El Dorado, Ark.; the Jayhawk Ordnance Works, Baxter Springs, Kans.; and the Tennessee Valley Authority, Muscle Shoals, Ala. The ammonium nitrate solution from the ordnance plants is shipped to plants with graining facilities for conversion into fertilizers in solid form. Thirteen of the Government-owned ammunition-loading plants contain facilities for graining ammonium nitrate. Late in 1945 five of these plants were producing solid ammonium nitrate crystals for sale to the Commodity Credit Corporation for resale as fertilizer. These plants were the Wolf Creek, Milan, Tenn.; Louisiana, Minden, Ala.; Kansas, Parsons, Kans.; Lone Star, Texarkana, Tex.; and Cornhusker, Grand Island Nebr. In these five plants, near the end of 1945, ammonium nitrate was being grained at the rate of 100,000 tons of nitrogen a year. The other ammunition-loading plants had operated their grainers for short periods at one time or another but at the end of the year had been shut down for a considerable period. The Tennessee Valley Authority operated its own fertilizer-producing facilities at Muscle Shoals, Ala. Late in 1945 ammonium nitrate solution facilities were being installed at the Defense Plant Corporation plant at Lake Charles, La., operated by the Mathieson Alkali Co. The Hercules Powder Co., Hercules, Calif., and the Allied Chemical & Dye Corp. are also reported to have been manufacturing ammonium nitrate.

According to the annual report of the Tennessee Valley Authority for the fiscal year ended June 30, 1945, the Authority produced ammonium nitrate both for military and agricultural interests during the year. Production for the armed forces ranged from relatively small amounts at some times to total plant capacity at others. Besides meeting military demands (15,400 tons of ammonium nitrate crystal), during the fiscal year TVA produced 111,400 tons of ammonium nitrate, treated by a TVA process to prevent caking, for fertilizer use. This 15-percent reduction from the previous year resulted from the demand of the War Department for munitions-grade ammonium nitrate crystal and ammonia. At the close of the fiscal year, however, all military production of ammonium nitrate had been ordered halted, and full-scale fertilizer production had been resumed. Considerable research was done during the year to replace the present ammonium nitrate graining process, which was recognized as potentially hazardous, relatively expensive, and not best-suited to producing fertilizer materials. Two processes investigated appeared definitely superior to the method now in use at the plant.

On February 1, 1944, distribution of the ammonium nitrate being produced in Government-owned plants for use in the manufacture of fertilizers was placed in the hands of the Commodity Credit Corporation, which in turn designated Associated Cooperatives, Inc., as its agent in the distribution of the material. In 1945 the Commodity Credit Corporation continued to purchase the solid ammonium nitrate crystals produced in Government-owned ammonium nitrate graining plants for resale as fertilizer material for domestic consumption and for export. The imported Canadian product is reported to be distributed in the United States by a private domestic company.

Several articles on the production, properties, and uses of ammonium nitrate have appeared in the past several months.[6]

Synthetic sodium nitrate.—The synthetic sodium nitrate consumed in the United States has, in the past, come from both domestic and foreign sources. From 1928 to 1945 the domestic production has come from a single unit—the Hopewell, Va., plant of the Allied Chemical & Dye Corp. In addition to the synthetic sodium nitrate from this source, small amounts were also imported from Germany and Canada in the period before World War II. The total annual prewar consumption of sodium nitrate (both natural and synthetic) is reported to have been approximately 1 million tons, of which 15 percent was consumed by industry (all synthetic) and the remaining 85 percent by agriculture (both natural and synthetic).[7] This would indicate that domestic consumption of synthetic sodium nitrate at that time exceeded 150,000 tons a year.

During the recent war little foreign synthetic sodium nitrate entered the United States, and the supply came almost entirely from the Hopewell plant. Little information is available regarding the current production or utilization of domestically produced synthetic sodium nitrate, but it is reported in the trade journals that production in 1945 is expected to be somewhat larger than in 1944.

Synthetic sodium nitrate has been under allocation, as was the natural product, under Schedule 80 (Nitrogen Compounds) of WPB General Allocation Order M-300 and was under the same restrictions as to use. Early in September 1945, this order was revoked, and synthetic sodium nitrate was removed from allocation as of September 30, 1945.

[6] Ross, W. H., Adams, J. R., Yee, J. Y., and Whittaker, C. W., Preparation of Ammonium Nitrate for Fertilizer Use: Ind. Eng. Chem., ind. ed., vol. 36, No. 12, December 1944, pp. 1088–1095.
Titlestad, N., Ammonium Nitrate Fertilizers from Government Ammonia: Am. Fertilizer, vol. 101, No. 10, 1944, pp. 9–10, 28, 30.
Davis, R. O. E., Explosibility and Fire Hazard of Ammonium Nitrate Fertilizer: U. S. Dept. of Agriculture Circ. 719, 1945, 22 pp.
Canadian Chemistry and Process Industries, Ammonium Nitrate Fertilizer Production: Vol. 29, No. 6, June 1945, pp. 392–405.
Ross, W. H., Yee, J. Y., and Hendricks, S. B., Properties of Granular and Monocrystalline Ammonium Nitrate: Ind. Eng. Chem., ind. ed., vol. 37, No. 11, November 1945, pp. 1079–1083.
Horner, C. K., Ammonium Nitrate from War to Peace: Domestic Commerce, vol. 33, No. 10, October 1945, pp. 33–34, 42.
Surplus Property Administration, Chemical Plants and Facilities. Rept. to Congress, Nov. 12, 1945, 80 pp. Progress in Disposal of Synthetic Ammonia and Alcohol Plants: Suppl. III, Dec. 5, 1945, 8 pp.

[7] Surplus Property Administration, Chemical Plants and Facilities: Washington, D. C., Gov't Printing Office, 1945, 80 pp. (see p. 80).

Prices of synthetic sodium nitrate remain under revised OPA Maximum Price Regulation 205. Quotations throughout 1945 were \$27 per ton for crude in bulk and \$30.05 per ton in 100-pound bags, carlots, works. Prices for refined granulated synthetic sodium nitrate in 10-ton lots were \$3.60 per 100 pounds, and in smaller lots, \$3.75 to \$4 per hundred pounds.

Second Revised Maximum Price Regulation 135 (including amendments 1–4), covered retail prices of agricultural sodium nitrate during 1945.

About mid-1945 it was announced by the WPB that Holston (Kingsport, Tenn.) byproduct sodium nitrate would be available during the latter part of the year for use in mixed fertilizers.

ORGANIC MATERIALS

Restrictions in the use of chemical nitrogen early in World War II so increased the demand for organic nitrogen-bearing materials that, to secure equitable distribution, it became necessary to institute Government control of sales. On May 7, 1943, the War Food Administration issued Food Production Order 12, effective May 1, 1943, banning purchase of these materials by fertilizer manufacturers without prior approval of the director of food production. A month later a revised Food Production Order 12, effective June 1, 1943, to July 1, 1944, limited the amount of the materials that could be used as fertilizer. The broad general War Food Order 12 was revoked on July 1, 1944, and replaced by a more limited War Food Order 105, covering only edible oilseed meals or cake. Restrictions are retained on these because of the heavy requirements for them for livestock feed, which remains the dominant factor in the situation. The order also contained provisions governing the distribution, for fertilizer use, of edible-type oil-seed meals of inedible quality. This order was revised and amended in Amendment 1, on June 30, 1945, the effective period to be July 1, 1945, to June 30, 1946. Individual purchasers were restricted to the same proportion of the total quantity of edible oilseed meal made available for fertilizer purposes as the proportion such person used for fertilizer purposes of the total quantity used by all applicants for such purposes during the period July 1, 1941, to June 30, 1942.

Calcium cyanamide ($CaCN_2$) is of importance to the domestic nitrogen industry as a competing source of nitrogen. It is not produced in the United States, but considerable quantities are imported each year from Canada, where it is produced at Niagara Falls, Ontario, by the North American Cyanamid, Ltd., wholly owned subsidiary of the American Cyanamid Co., in a plant leased from the parent company. It is marketed under the trade name Cyanamid for both agricultural and industrial uses. Imports in 1945 were 141,057 short tons. Cyanamide was under allocation with other nitrogen compounds during most of 1945 under Schedule 80 (Nitrogen Compounds) of WPB General Allocation Order M–300. This schedule, however, was revoked and cyanamide removed from allocation as of September 30, 1945.

MINOR NONMETALS

By G. W. Josephson and G. Richards Gwinn[1]

SUMMARY OUTLINE

GRAPHITE

Production and sales of domestic natural graphite began to decline in 1944, and this trend continued through 1945. There are too few domestic producers to allow publication of separate statistics on the amorphous and crystalline types, but the accompanying table shows combined figures for the past 5 years. Producers' stocks totaled 427 short tons at the end of the year.

Production and shipments of natural graphite in the United States, 1941–45

Year	Production (short tons)	Shipments		Year	Production (short tons)	Shipments	
		Short tons	Value			Short tons	Value
1941	2,748	2,645	$197,869	1944	5,408	5,768	$349,663
1942	7,120	7,253	401,690	1945	4,888	5,334	289,207
1943	9,939	9,597	903,102				

A substantial quantity of artificial graphite is manufactured in the United States by the Acheson Graphite Division of the National Carbon Co., Inc., the International Graphite & Electrode Corp., the Great Lakes Carbon Corp., and the Stackpole Carbon Co. Petroleum coke is used as the raw material. The coke is formed into electrode shapes, and an elaborate heat-treatment process gradually converts them into graphite electrodes. These graphite electrodes do not compete with natural graphite, but a considerable tonnage of artificial graphite powder is produced by intent or as a byproduct, and this material has wide use in industry in direct competition with natural graphite. Owing to the small number of producers, the Bureau of Mines is not at liberty to publish this figure.

Production of natural graphite in the United States has flourished only in times of war, when importation of high-grade foreign graphite has been greatly curtailed or cut off. The numerous failures in

[1] Figures on imports and exports compiled by M. B. Price, of the Bureau of Mines, from records of the U. S. Department of Commerce.

peacetime have been caused principally by inability to meet foreign competition in the market for large tough flakes used in crucibles. Estimates of domestic reserves based simply on flake size are misleading, because resistance to mechanical break-down in the mixing process is a major factor in crucible making. A review of the specifications of graphite for crucible use,[2] and a summary of developments in the Alabama graphite industry during the war[3] have been released recently.

As procurement became less difficult, the War Production Board removed restrictions on all types of graphite. Ceylon amorphous, either in lump or ground form, having more than 95 percent graphitic carbon, was retained on the list of "strategic" materials until September, but on April 1, 1945, public purchase of all other types was discontinued, and procurement was left to private contract. On September 18, 1945, Order M-61, covering graphite, was revoked.

Graphite (natural and artificial) imported for consumption in the United States, 1941–45

Year	Crystalline				Amorphous				Total (natural and artificial)	
	Flake		Lump, chip, or dust		Natural		Artificial			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	4,877	$289,322	2,900	$370,413	33,382	$1,363,434	38	$1,384	41,197	$2,024,553
1942	6,031	412,919	4,152	601,150	33,569	1,480,079	169	4,739	43,921	2,498,887
1943	5,311	493,382	1,012	117,795	22,390	331,800	205	15,515	28,918	958,492
1944:										
Canada	105	28,969	80	18,733	640	51,734	131	10,299	956	109,735
Ceylon			1,303	207,599	385	61,448			1,688	269,047
Madagascar	6,086	634,262	185	25,500					6,271	659,762
Mexico					17,269	232,430			17,269	232,430
	6,191	663,231	1,568	251,832	18,294	345,612	131	10,299	26,184	1,270,974
1945:										
Brazil					33	3,638			33	3,638
Canada	101	25,120			1,178	92,308	154	6,223	1,433	123,651
Ceylon			1,324	187,771	842	118,020			2,166	305,791
Madagascar	2,782	261,412	3,883	370,471					6,665	631,883
Mexico					25,879	350,063			25,879	350,063
Mozambique					110	5,571			110	5,571
	2,883	286,532	5,207	558,242	28,042	569,600	154	6,223	36,286	1,420,597

The WPB has reported that in 1944 a total of 4,430 short tons of Madagascar flake was consumed as follows: 81 percent in crucibles, 3 in retorts, 10 in lubricants, and 6 in other uses. In 1943 it was reported that 578 short tons of crucible-grade Ceylon lump and chip graphite were used—37 percent went into crucibles; 16 into retorts; 44 into stoppers, sleeves, and nozzles; 1 into foundry facings; and 2 into other uses. Of the 950 tons of Ceylon (97–98 percent C) large lump consumed in 1944, 69 percent was used in carbon brushes, 19 in pencils, 2 in lubricants, 3 in bearings, 1 in batteries, and 6 in other uses.

[2] Gwinn, G. R., Graphite for Manufacture of Crucibles: Am. Inst. Min. and Met. Eng. Tech. Pub. 1909, 1945, 4 pp.

[3] Pallister, H. D., and Smith, R. W., Alabama Flake Graphite in World War II: Am. Inst. Min. and Met. Eng., Tech. Pub. 1908, 1945, 11 pp.

In 1945 exports of graphite products were reported to be 1,308 short tons, valued at $134,414.

Trade-journal quotations of prices for graphite, f. o. b. New York, were: Ceylon lump, 10–12 cents per pound; carbon lump, 9–10 cents; chip, 7–8 cents; dust, 4–5 cents; Madagascar flake, 9–10 cents. Prices nominal. No. 1 flake was 9–16 cents per pound; No. 2, 7 cents upward; fine-ground, 55 to 70 percent carbon, 3 cents upward; amorphous, 3 cents upward. Prices nominal. Crude amorphous graphite was $14 to $30 per ton according to grade.

World production figures for graphite covering the period 1915–39 were published in Minerals Yearbook 1940 (p. 1414), and the accompanying table shows available statistics for 1937–45.

World production of natural graphite, 1937–45, by countries, in metric tons [1]

[Compiled by B. B. Waldbauer]

Country [1]	1937	1938	1939	1940	1941	1942	1943	1944	1945
Argentina	25	28	--------	100	135	244	250	(2)	(2)
Australia:									
New South Wales	--------	--------	--------	41	64	3	(2)	142	(2)
Queensland	12	10	--------	63	320	225	360	52	(2)
South Australia	2	--------	--------	--------	50	71	88	253	(2)
Tasmania	--------	--------	--------	5	5	--------	7	(2)	(2)
Western Australia	--------	--------	--------	1	(3)	6	11	--------	(2)
Brazil (exports)	--------	--------	--------	--------	60	72	19	199	(2)
Bulgaria	--------	--------	23	50	(2)	(2)	(2)	(2)	(2)
Canada	[4] 2,675	[4] 1,044	[4] 1,199	[4] 1,381	[4] 905	[4] 463	1,726	1,435	1,669
Ceylon (exports)	17,660	11,972	22,756	24,414	27,670	27,872	20,830	12,461	7,946
Czechoslovakia	5,144	(2)	(2)	(2)	[5] 1,521	[5] 2,627	(2)	(2)	(2)
Egypt	--------	--------	--------	--------	--------	--------	--------	260	152
Germany:									
Austria	18,158	16,852	24,013	22,991	24,264	26,203	(2)	(2)	(2)
Bavaria	23,544	28,106	28,180	29,891	29,771	33,316	34,960	36,357	(2)
Greenland	60	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
India, British	567	465	951	311	827	1,072	1,188	(2)	(2)
Indochina (exports)	--------	1	2	(2)	(2)	(2)	(2)	(2)	(2)
Italy	5,411	5,485	5,715	4,996	4,136	5,483	(2)	(2)	1,793
Korea (Chosen) [4]	43,569	50,348	78,501	[6] 12,591	(2)	(2)	(2)	(2)	(2)
Madagascar	[4] 12,387	14,545	12,196	15,311	13,018	9,562	12,949	14,478	[4] 6,451
Mexico	11,210	9,611	9,815	12,327	16,928	20,811	20,677	12,977	23,634
Morocco:									
French	336	307	886	529	571	1,067	265	213	(2)
Spanish	--------	73	(2)	352	414	888	226	42	100
Norway	3,638	3,802	4,333	(2)	(2)	2,933	(2)	3,538	(2)
Portuguese East Africa	(2)	(2)	(2)	(2)	(2)	165	428	(2)	(2)
South-West Africa	--------	--------	--------	71	188	181	1,758	1,973	1,318
Spain	--------	--------	54	353	23	251	136	1,050	[7] 1,666
Sweden	25	48	165	153	(2)	(2)	(2)	(2)	(2)
Union of South Africa	63	54	59	78	74	335	55	130	128
United States:									
Amorphous	(8)	(8)	(8)	(8)	} 2,493	6,459	9,016	4,906	4,434
Crystalline	(8)	(8)	(8)	--------					

[1] In addition to countries listed graphite is produced in France, Japan, Kenya, Nyasaland, and U. S. S. R. but production data are not available.
[2] Data not available.
[3] Less than 1 ton.
[4] Exports.
[5] Production of Bohemia and Moravia only.
[6] April to December, inclusive.
[7] January to September, inclusive.
[8] Bureau of Mines not at liberty to publish figures.

GREENSAND

Production of greensand by three companies in New Jersey in 1945 reached 4,738 short tons, and shipments totaled 4,986 tons valued at $477,919. Three companies in 1944 produced 7,896 tons and shipped 4,908 tons valued at $505,651. All shipments during recent years were of refined material used in water-softening compounds and water-purification agents.

Statistics for greensand sold or used are presented in the following table.

Greensand marl sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	11,120	$619,664	1944	4,908	$505,651
1942	10,110	448,440	1945	4,986	477,919
1943	10,056	522,124			

KYANITE, ANDALUSITE, AND DUMORTIERITE

Domestic production and imports of kyanite increased in 1945. Most of the imported material came from India, but a minor tonnage came from British East Africa. Receipts from Australia, believed to be sillimanite, totaled 341 short tons valued at $3,867. Approximately 179 tons, valued at $10,276, of material that entered from Canada was described as "crude sillimanite (synthetic)."

A summary of trade statistics for recent years is given in the following table.

Domestic shipments, imports, new supply, and stocks of kyanite in the United States, 1941–45

Year	New supply						Stocks of Indian kyanite [1]	
	Domestic shipments		Imports		Total new supply			
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
1941	8,335	$175,581	14,285	$175,218	22,620	$350,799	(2)	(2)
1942	8,708	190,750	6,524	93,743	15,232	284,493	9,485	$449,317
1943:								
British India			9,972	105,042	9,972	105,042	10,883	515,527
United States	9,561	238,649			9,561	238,649		
	9,561	238,649	9,972	105,042	19,533	343,691	10,883	515,527
1944:								
British East Africa			55	591	55	591		
British India			5,680	66,850	5,680	66,850	8,618	409,355
United States	(3)	(3)			(3)	(3)		
	(3)	(3)	5,735	67,441	(3)	(3)	8,618	409,355
1945:								
British East Africa			560	7,000	560	7,000		
British India			13,994	160,997	13,994	160,997	8,000	(2)
United States	(3)	(3)			(3)	(3)		
	(3)	(3)	14,554	167,997	(3)	(3)	8,000	(2)

1 Industry and Government stocks as of December 31, as reported by Miscellaneous Minerals Division, War Production Board, Reconstruction Finance Corporation, and consumers.
2 Figures not available.
3 Bureau of Mines not at liberty to publish figures.

After the end of hostilities demand for kyanite continued high, and growing transportation and food problems in India indicated a possible shortage for 1946.

At the end of the year stocks of crude Indian kyanite totaled approximately 8,000 tons, of which 3,058 were in the Government stockpile and the rest were held by private companies.

The cost of Indian kyanite delivered to stock piles in this country in 1945 was about $38 per short ton. Prices of domestic kyanite established by the Office of Price Administration ranged from $24 per short ton for raw kyanite, 35-mesh, in carlots, to $42.50 for 325-mesh material, less than carlots, in 100-pound bags; and for calcined kyanite from $31.50 per short ton, 35-mesh, in carlots, to $47.50 for 325-mesh material, less than carlots, f. o. b. Cullen or Pamplin, Va.

In 1945 production of kyanite was reported by the Kyanite Mining Corp., near Farmville, Va., and by the Vitrefrax Corp., near Ogilby, Calif. The Vitrefrax Corp. converts all of its output to mullite products, but the Kyanite Mining Corp. sells kyanite on the open market.

Champion Sillimanite, Inc., produced andalusite in Mono County, Calif., and dumortierite in Pershing County, Nev. This company is the only producer of these minerals in the United States. They are not sold on the open market but are used by the parent company, Champion Spark Plug Co., for manufacturing spark-plug cores.

Owing to the relatively high quality of Indian kyanite, the United States depends on it to supply a large portion of domestic needs, but the search for an adequate domestic supply continues. The kyanite that occurs as small crystals in schists in Virginia, North Carolina, and Georgia has given trouble when used in brick and block but is satisfactory for plastics and refractory mortars and, when the iron content is reduced, for glass. South Carolina topaz serves as a good bond and improves the quality. Georgia massive kyanite is good material, but further exploration will be required to prove the existence of commercial reserves. A large tonnage of true sillimanite has been indicated in Georgia, South Carolina, and North Carolina, and a few deposits may be rich enough for commercial development. A flotation process developed at the Southern Experiment Station of the Bureau of Mines beneficiates the material satisfactorily. The refractory qualities of the sillimanite concentrate are now being tested.[4]

During the war Germany, being cut off from Indian kyanite, developed a synthetic sillimanite that is said to have given good service. It was made from clay, aluminum hydrate, fused alumina, and feldspar. They were mixed, burned to mullite, and crushed for refractory use. The product was said to cost over three times as much as Indian kyanite.

LITHIUM MINERALS

During the war the utilization of lithium products reached record levels. New plants and mines were opened to furnish large quantities of lithium compounds, such as lithium hydride—a source of hydrogen for inflating radio antenna balloons included in Navy rescue equip-

[4] Information furnished by Hewitt Wilson, Bureau of Mines, Norris, Tenn.

ment; but when Government contracts were canceled, other markets of comparable size were not available. As the cut-back came at the end of 1944, the effect was felt throughout 1945, and mine shipments of lithium minerals—spodumene, amblygonite, lepidolite, and dilithium sodium phosphate—declined 82 percent from the record of 13,319 tons set in 1944.

The spodumene mine operated by the Solvay Process Co. at Kings Mountain, N. C., was idle after February, and the Black Hills Tin Co., Tinton, S. Dak., was inactive throughout 1945, but several other companies reported sales of spodumene, amblygonite, and lepidolite in South Dakota, and one mined lepidolite in Colorado.

Although production of all other lithium raw materials declined in 1945, the output of dilithium sodium phosphate increased. This compound is recovered as a flotation concentrate by the American Potash & Chemical Corp. at Searles Lake, Calif.[5]

Tonnage and value of lithium ores and compounds shipped in recent years and approximations of total Li_2O content are shown in the accompanying table.

The eventual loss of Government orders was foreseen by the industry, and considerable effort went into market analysis and laboratory research to find new and larger peacetime markets. Although their comparatively high cost is a handicap, lithium compounds show promise in many fields. They are of value in glass, welding fluxes, special lubricants, air conditioning, storage batteries, fluorescent light tubes, and as an alloying element; the organic compounds of lithium are also being investigated.

The industry is now in a difficult reconversion period in which it is attempting to expand its markets sufficiently to utilize the available production capacity.

Lithium sold from $12.50 to $20.00 per pound in 1945, but producers believe that prices as low as $5 per pound may be reached if volume consumption is attained in the future. Trade journal prices of lithium ores were as follows: Spodumene, $5 to $6 per 20 pounds of contained Li_2O on 6-percent grade, carlots, North Carolina; amblygonite, 8 to 9 percent Li_2O, $40 to $50 per short ton, f. o. b. mine; and lepidolite, lump, $24 to $25 per ton for ordinary grades, f. o. b. mine. The price of dilithium sodium phosphate has been reported at about $232 per ton.

Shipments of lithium ores and compounds from mines in the United States, 1935–39 (average) and 1940–45

Year	Ore (short tons)	Value	Li_2O (short tons)	Year	Ore (short tons)	Value	Li_2O (short tons)
1935-39 (average)	1,327	$48,280	88	1943	8,155	$314,660	463
1940	2,011	80,679	113	1944	13,319	552,977	848
1941	3,832	115,718	209	1945	2,446	285,520	274
1942	5,405	243,516	299				

[5] Gale, W. A., Lithium from Searles Lake: Chem. Ind., vol. 57 No. 9, September 1945, pp. 442–446.

MINERAL EARTH PIGMENTS

[Prepared by Charles L. Harness]

Total iron oxide and earth-pigment sales by domestic processors increased over 1944 sales, despite sharp drops in military end uses in the last half of 1945. Direct sales from processors to the Army are said to have been negligible since 1944; and direct sales to the Navy paint plants, although substantial in early 1945, declined to a very small volume later in the year. The loss of military orders was more than compensated by revival in demands from peacetime industries, mostly paints, linoleum, and mortar colors. The unusually large sales of red oxides presaged a general painting of farm buildings and box cars. The only iron oxide pigments that were in easy supply at the end of 1945 were the yellows, both natural and synthetic, owing to the lowered requirements for olive drab paints.

Mineral Pigments Corp., Muirkirk, Md., announced that it was erecting a plant for the production of pure red oxides from metal. The oxides are said to have an extremely fine particle size and an almost complete absence of soluble salts.[6]

Natural mineral pigments and manufactured iron oxide pigments sold by processors in the United States, 1944–45, by kinds

Pigment	1944		1945	
	Short tons	Value	Short tons	Value
Mineral blacks	3,388	$94,192	2,960	$61,388
Precipitated magnetic blacks	1,110	191,238	(1)	(1)
Natural brown oxides (metallic browns)	7,201	329,721	6,569	290,011
Vandyke brown (finished pigment)	162	19,658	284	52,084
Sap brown	453	98,095		
Pure browns (96 percent or better iron oxides)	1,025	195,281	(1)	(1)
Natural red oxides	19,267	795,895	18,051	714,856
Pure red oxides (98 percent or better Fe_2O_3)	9,948	1,788,136	13,347	2,457,565
Venetian reds	8,184	595,558	8,954	650,815
Pyrite cinder	494	31,561	679	42,545
Other red iron oxides	6,339	557,505	11,064	1,050,695
Natural yellow oxides (high Fe_2O_3)	4,403	157,911	(1)	(1)
Pure yellows (85 percent or better Fe_2O_3)	16,082	2,210,436	14,060	1,913,609
Ochers (low Fe_2O_3)	9,547	332,846	11,018	361,441
Siennas:				
Burnt	762	100,870	853	109,498
Not burnt	2,314	280,824	2,563	306,621
Umbers:				
Burnt	1,854	96,513	2,685	232,899
Not burnt	4,126	120,242	(1)	(1)
Other	359	19,970	7,927	581,147
	97,018	8,016,452	101,014	8,825,174

[1] Included under "Other."

The table listing total sales by States customarily shown in this section is omitted because the sales from only one State (Pennsylvania) can be shown separately, amounting to 31,680 short tons in 1945 valued at $3,197,835. States and statistics that could be shown separately in 1944 were Georgia, 6,216 tons, $128,659; and Pennsylvania, 34,995 tons, $3,035,145.

[6] Oil, Paint and Drug Reporter, vol. 148, No. 18, Oct. 29, 1945, p. 72.

Dry ocher, sienna, umber, and other forms of iron oxide for paint exported from the United States, 1942–45, by countries

Country	1942		1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Argentina	50	$9,043	34	$7,510	19	$5,837	1	$721
Belgian Congo	62	8,824	42	4,298	40	4,106	50	6,450
Bolivia	5	1,022	34	6,999	10	1,414	(1)	88
Brazil	108	22,188	66	14,618	249	54,287	139	18,054
Canada	2,364	151,109	2,660	198,296	3,333	194,489	3,484	285,177
Chile	59	10,868	81	18,776	90	19,656	30	10,962
Colombia	97	26,857	165	39,401	137	30,777	93	21,728
Cuba	359	33,681	314	44,751	238	32,198	386	55,859
Curaçao (N. W. I.)	12	1,517	59	29,077	10	937	5	893
Mexico	153	32,902	283	59,428	226	44,004	165	33,870
Panama: Republic of	7	1,193	69	4,476	120	8,937	71	7,584
Peru	21	4,597	39	4,707	61	8,621	23	5,653
Portugal			78	3,154	160	6,488	195	8,648
Sweden							131	9,006
Venezuela	100	16,112	94	18,649	112	17,407	130	31,799
Other countries	234	42,744	352	50,183	360	55,692	313	55,394
	3,631	362,657	4,370	504,323	5,159	484,850	5,216	551,886

[1] Less than 1 ton.

Selected mineral pigments imported for consumption in the United States, 1942–45

Pigment	1942		1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Iron oxide pigments:								
Natural	1,936	$60,405	581	$22,051	1,494	$61,231	2,837	$125,370
Synthetic	1,978	250,779	800	92,966	686	86,188	439	58,380
Ocher, crude and refined	477	12,036	78	1,810	4	221	784	36,608
Umber, crude and refined	5	159			1,172	31,599	1,989	57,281
Vandyke brown	(1)	43						
	4,396	323,422	1,459	116,827	3,356	179,239	6,049	277,639

[1] Less than 1 ton.

Receipts of Spanish red oxide were reported to be regular but small, owing to transport difficulties in the interior of Spain. Most domestic processors have been offering replacements for Spanish oxide for several years. French ochers were still off the market, and Italian siennas were said to be available only in small quantities and at high prices. Small amounts of pure oxides from Great Britain were imported in 1945, but at high prices. Turkey umbers from Cyprus livened the foreign pigment situation late in 1945, when supplies became available in quantity. Persian Gulf oxide has been off the market almost completely since 1940, but importers hope that shipments will be resumed in 1946.

Prices of finished earth pigments, which are quoted in cents per pound, were generally unchanged during 1945, according to the Oil, Paint and Drug Reporter. Precipitated magnetic blacks, in barrels, carlots, works, were quoted at 8½; metallic browns were 2½; synthetic (pure) browns, 12; siennas, American type, 3¾ to 5; burnt siennas, Italian type, 8¾ to 10¾; raw siennas, American type, 4 to 10; raw siennas, Italian type, 8 to 10; umbers, Turkey type, 4¾ to 5⅞, depending on point of purchase; synthetic (pure) red iron oxides, 9 to 9¾; Venetian reds, 2.2 to 4, depending on iron oxide content; natural (metallic) red oxide, 2; natural yellow oxides, high iron, 4½ to 6¼; synthetic (pure) iron oxide yellows, 6.85; and domestic ochers, French type, 8.45.

MINERAL WOOL

Production statistics of the mineral-wool industry were compiled for 1942 to 1944 by the Bureau of Mines, and these figures were published in the Minor Nonmetals chapters of Minerals Yearbooks for 1943 and 1944. No canvass of the industry was made by the Bureau of Mines for 1945 as this function was transferred to the Bureau of the Census. As no canvass covering 1945 has been made by the Bureau of the Census, no statistics for that year are available.

In 1945 mineral-wool production was at a very high level. Even during the war, when construction was limited, mineral-wool output increased owing to heavy demand for military and industrial use and for insulating existing buildings. When hostilities came to an end and new home construction began to increase, demand intensified.

In 1944 there were 38 companies operating 51 plants in 19 States. There were probably more in 1945, as trade journals reported many new plants under construction and old plants being expanded.

Although competition is not currently as strong a force as in a buyers' market, attention is being given to refinement in equipment that will give more efficient operation. Reports of new plants mention installation of waste-heat boilers and preheaters for blast air, which will reduce heat losses.

During the war, mineral and glass wools were used in many new products. Panels, of various thicknesses, of resin-bonded wool were used for heat and sound insulation in military equipment. Some were faced with asbestos or glass cloth for fireproofing and appearance. Addition of glass fiber to asbestos roving relieved an asbestos shortage during one period. Mineral wool served as a packing for shipping corrosive acids. Superfine glass fibers that have exceptional insulating capacity and light weight were used in some aircraft. For some structural uses, plastics strengthened by glass fibers can compete successfully with metals.

For the peacetime market the mineral-wool industry offers a well-tested line of general and specialized products that are certain to be widely used, and current research is expanding the market.

As there is a wide diversity in test procedures used in the mineral-wool industry, the Bureau of Standards compiled and presented to the industry for approval, a Recommended Commercial Standard for Industrial Mineral Wool, All Types—Testing and Reporting—TS-4030. By establishing a uniform system of testing and reporting, much of the confusion resulting from diversity of test procedures should be eliminated.

MONAZITE

Monazite has been produced from small deposits in the Southeastern States, but now the commercial supplies of the United States are imported. At present the principal sources are beach deposits along the coasts of Brazil and India. The mineral occurs in black sand with zircon, rutile, ilmenite, and other minerals, from which it is separated by gravity, electrostatic, and electromagnetic methods. Imports totaled 4,980 short tons in 1943, but in 1945 only about one-tenth of that amount was reported by the United States Department of Commerce. India is usually the main supplier; but, as is shown in the accompanying table, most of the import tonnage came from Brazil in 1945.

Monazite sand and other thorium ore,[1] imported for consumption in the United States, 1941–45, by countries

Country	1941		1942		1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Brazil	734	$25,240	1,346	$62,555	1,911	$88,548			437	$15,342
India and Dependencies	2,714	82,068	3,052	112,928	3,033	128,379	384	$13,782	112	4,239
United Kingdom					36	3,553				
	3,448	107,308	4,398	175,483	4,980	220,480	384	13,782	549	19,581

[1] Quantities are gross weight; monazite content not reported.

Monazite is a complex mineral, principally a phosphate of cerium, lanthanum, and other rare earths but also containing thorium, silica, and mesothorium. Although only a few years ago monazite was said to be moribund, it now is sufficiently essential to be classified as a strategic mineral. By complex chemical processes the mineral is converted into a number of valuable products. Rare-earth fluorides and oxides are used in electrodes; misch metal in pyrophoric alloys; and rare-earth oxides, thorium and rare-earth hydrates and fluorides, and ammonium nitrates in optical glass. Rare-earth acetates are utilized to mildewproof textiles, and the oxide is used in polishing glass, as it is faster than rouge. Gas mantles are treated with thorium nitrate. More uses of these products can be listed than space will allow. Essential as are the established uses of monazite, they may be dwarfed in future by possible utilization in the rapidly developing field of atomic fission.

As such a large portion of the output of the products of monazite is furnished by a single company, the Bureau of Mines is not at liberty to publish production and use statistics.

Interest in monazite is developing in Australia. Deposits are known to occur in the beach sands of northern New South Wales and southern Queensland.[7]

OLIVINE

Shipments of olivine in North Carolina in 1945 were somewhat higher than in 1944, but the Bureau cannot publish the figures without revealing the output of individual firms. As in the previous year, the entire production was consumed in refractories. Shipments of olivine by domestic producers during recent years are shown in the following table.

[7] Chemical Engineering and Mining Review, Glass Polishing with Rare Earth Oxides: Vol. 38, No. 448, Jan. 10, 1946, pp. 125–128.

Olivine sold or used by producers in the United States, 1941–45

Year	Short tons	Value	Year	Short tons	Value
1941	4,828	$24,401	1944	3,270	$35,207
1942	5,739	45,201	1945	(1)	(1)
1943	5,415	48,633			

[1] Data not available for publication.

United States Patent 2,372,571, relating to the production of metallic magnesium by direct reduction of magnesium silicates, was granted to Dr. F. J. Hansgirg on March 27, 1945. Two other patents, 2,384,008 and 2,384,010, devoted respectively to converting unstable hydrous magnesium silicates of the serpentine group (hydrated olivine rocks) into basic products, and a method of producing magnesium sulfate from magnesium oxide-bearing materials by the use of sulfurous acid, were granted on September 4, 1945, to H. R. Brandenburg. It is reported that a refractory-grade olivine deposit on Cypress Island in the San Juan Archipelago, Wash., has been outlined.[8]

PERLITE

In the last few years interest in the use of expanded perlite has been increasing. Perlite rock is one of the glassy members of the rhyolites, varying in texture from porphyritic to glassy. This rock contains some water, and when heated close to the melting point it expands into a lightweight, cellular form. The heating curve must be carefully controlled to produce a sufficiently strong and uniform product. The weight of aggregate usually ranges from 12 to 16 pounds per cubic foot.

Although expanded perlite is not yet firmly established commercially, it is being used as a lightweight aggregate, as loose filler for insulation, and as chicken litter; fines have been used in a cleanser. The current building boom should assist perlite in gaining its share of the market in competition with expanded slag, clay, vermiculite, and other lightweight materials. At least nine companies are actively experimenting, and several hundred tons have been produced commercially in Arizona, California, and Nevada. The following patents describe some of the processes developed recently: 2,207,911; 2,209,163; 2,209,170; 2,247,120; 2,306,462.

RADIO-GRADE QUARTZ

A period of great expansion in the use of quartz crystal came to an end with the surrender of Japan. Although output of oscillators had tapered off somewhat during the first half of the year, the volume was large until military demand collapsed in August. Many companies went out of business or turned their attention to other products. A total of 113 companies were in production in 1944, but by the end of June 1945 the number had declined to 96. Although considerable cutting equipment went out of production after the war, there remains a large capacity available to supply the coming peacetime needs. It

[8] Brick and Clay Record, Washington Olivine Deposits to be Developed Commercially: Vol. 107, 1945, No. 4, p. 60.

has been estimated that postwar production of oscillators will come from about 20 companies.

Much of the remaining stock of crystal was turned over to the contracting Government agencies, who in turn assigned it to the War Assets Administration as surplus material. Stocks of crude quartz held by the Metals Reserve Company were also declared surplus and were acquired by WAA. The bulk of the radio-grade material is being transferred to the stock pile of the Army and Navy Munitions Board.

Quartz crystal has been recognized by Congress as one of the strategic minerals that must be stock-piled for national defense. Small deposits are known to exist in the United States, but they are so limited that our commercial supply comes almost entirely from foreign sources.

At present Brazil enjoys a virtual monopoly. Up to now, quartz crystal has been mined and classified in Brazil and has been shipped crude to the consuming countries, where it is cut into oscillators, resonators, and optical shapes. The war stimulated this trade tremendously. Electricity is the lifeblood of mechanized warfare. Communication, detection, and control devices are more essential than ever before. As quartz-crystal oscillators and resonators assure accurate frequency control for electrical circuits, they were used by the millions to equip the Allied armies. The need was so great that when the submarine warfare was at its height crystals were flown from Brazil to the United States in planes. The United States Government assisted Brazil to expand output by furnishing necessary equipment, technical advice, and funds.

An accompanying table shows the number of piezoelectric devices produced during the war years.

Imports of uncut quartz crystal, consumption of radio-grade quartz, and production of finished crystals in the United States, 1940–45

Year	Imports of uncut quartz crystal [1]		Consumption of radio-grade quartz [2] (pounds)	Production of finished crystals [3] [4] (number)
	Pounds	Value		
1940	126, 521	$264, 436	31, 000	(5)
1941	2, 237, 608	3, 830, 344	59, 000	(5)
1942	2, 612, 106	8, 987, 108	682, 000	6, 888, 000
1943	3, 356, 000	11, 409, 803	1, 588, 000	22, 575, 000
1944	2, 300, 506	11, 178, 643	1, 858, 000	29, 939, 000
1945	1, 329, 798	6, 190, 621	1, 040, 000	18, 918, 000

[1] Includes optical-grade quartz used in production of optical instruments.
[2] 1940–44, WPB.
[3] 1942–44, WPB.
[4] Includes oscillators, resonators, and other piezoelectric devices.
[5] Data not available.

Germany had acquired a small stock of crystals before the war, but when cut off from Brazil it tried to develop synthetic crystals as substitutes. A few showed limited promise, but they were still in the laboratory stage when the war ended.

Although no postwar market is in sight comparable in size with the demand during the war, the quantity of quartz crystal that will be used in radio and other electrical circuits promises to be much larger than before the war. The outlook is so favorable that Brazil has recently shown interest in developing a cutting industry and would then offer for sale partly or fully processed products as well as crude quartz.

As shown in the accompanying table, both imports and consumption of quartz crystal (Brazilian pebble) were lower in 1945 than in 1944—imports 42 percent and consumption 44 percent. Except for 1 pound reported from Chile, all imports came from Brazil in 1945.

In the early days of the war, the number of oscillator plates obtained per pound of usable quartz was relatively low—9.5 in 1942; but with improvement in cutting efficiency, recovery of imperfect plates, and use of smaller sizes, the number increased until, in 1945, approximately 18 plates were produced per pound.

The search for domestic sources of high-grade quartz crystal ended in practical failure. A few thousand pounds (3,934 in 1944) are known to have been produced, but these quantities were negligible in comparison with requirements. Although small quantities probably were found, there is no record of any domestic production in 1945.

Government purchase prices paid in 1945 (ranging from $1.56 to $36.95 per pound, according to quality) were given in detail in the Minor Nonmetals chapter of Minerals Yearbook, 1943. Some Government buying of crystal continued throughout 1945, as contracts with Brazilian producers provided for a gradual closing of the program.

An accompanying table shows the selling prices of the various grades and sizes of quartz crystal in the United States in 1945.

Metals Reserve Company selling prices for quartz crystal, faced material [1]

[Price per pound, f. o. b. Bureau of Standards, Washington, D. C.]

Size (grams)	Grade 1			Grade 2			Grade 3
	30–45 percent usability	45–60 percent usability	60–100 percent usability	30–45 percent usability	45–60 percent usability	60–100 percent usability	60–100 percent usability
200–300	4.95	7.45	9.90	4.15	6.20	8.25	2.45
300–500	6.60	9.90	13.20	5.50	8.25	11.00	3.30
500–700	8.25	12.40	16.50	6.90	10.30	13.75	4.10
700–1,000	9.90	14.85	19.80	8.25	12.40	16.50	4.95
1,000–2,000	12.40	18.55	24.75	10.30	15.45	20.65	6.20
2,000–3,000	14.85	22.30	29.70	12.40	18.55	24.75	7.45
3,000–4,000	16.50	24.75	33.00	13.75	20.65	27.50	8.25
4,000–5,000	18.15	27.25	36.30	15.15	22.80	30.25	9.10
5,000–7,000	19.80	29.70	39.60	16.50	24.75	33.60	9.90
7,000–10,000	21.45	32.20	42.90	17.90	26.80	35.75	10.75
Over 10,000	23.10	34.65	46.20	19.25	30.00	38.50	11.50

[1] 20 percent discount allowed for unfaced material (irregulars) in sizes of 200–500 grams. 10 percent discount allowed for unfaced material (irregulars) in sizes larger than 500 grams. Optical quartz 50 percent higher than 60–100 percent usability prices of Grade 1. Less than 200-gram faced material (80 percent or better eye clean)-$2.25 per pound.

WPB Order M–146, covering conservation of quartz crystals, was revoked August 20, 1945.

A paper describing some of the Brazilian deposits was published early in 1946.[9]

[9] Knouse, Frederick L., Deposits of Quartz Crystal in Espirito Santo and Eastern Minas Gerais, Brazil: Am. Inst. Min. and Met. Eng., Min. Technol., vol. 10, No. 2, March 1946, pp. 1–9.

STRONTIUM MINERALS

[By Charles L. Harness]

The celestite (strontium sulfate) industry waned further in 1945, four producers reporting shipments of 2,784 short tons valued at $27,840, compared with 3,005 tons valued at $48,165 in 1944.

During the war, domestic celestite was valuable as a substitute for barite in weighting rotary oil-well drilling muds and to some extent in the manufacture of strontium chemicals. As war demands eased, barite became more plentiful in the drilling areas, and also requirements for strontium chemicals in tracer bullets and flares were reduced drastically. Celestite producers have been forced to seek additional outlets, generally local, such as use in purifying caustic soda solutions and in making small quantities of strontium chemicals for peacetime application.

Imports of celestite for consumption in the United States, by countries, 1943–45, in short tons

Country	1943		1944		1945	
	Short tons	Value	Short tons	Value	Short tons	Value
United Kingdom	1,367	$21,347	1	$652		
Mexico	11,060	148,233	3,170	38,191	3,016	$38,365
Spain	4,454	80,000	2,622	47,576	675	12,251
	16,881	249,580	5,793	86,419	3,691	50,616

Exports of strontium chemicals from the United States, 1944–45, in short tons

	1944		1945	
	Short tons	Value	Short tons	Value
Strontium nitrate	223	$36,698	284	$52,129
Strontium oxalate	2	1,198	19	15,058
Other	13	7,823	16	24,254
	238	45,719	319	91,441

The following producers reported shipments in 1945: W. C. Buehler & W. N. Rowe, 1555 Sunset Ave., Pasadena 3, Calif.; The Pan-Chemical Co., 205 First National Bank Building, Pomona, Calif.; Milwhite Co., Inc., Cotton Exchange Building, Houston, Tex.; and Bennett-Clark Co., Inc., Nacogdoches, Tex.

A flow sheet covering the preparation of strontium chemicals from celestite was reviewed.[10]

[10] Chemical and Metallurgical Engineering, Strontium Chemicals: Vol. 53, No. 1, January 1946, pp. 152–155.

TOPAZ

Shipments of topaz in 1945 from the Brewer mine, near Kershaw, S. C., by the United Feldspar & Minerals Corp. of Spruce Pine and the Carolina Mining & Exploration Corp. of Naples, N. C., decreased from the 1944 total. Two products were marketed—crude topaz in lump form and crushed and screened material. Topaz was used in 1945 by the refractory industries and for thinning slag in open-hearth furnaces.

VERMICULITE

Sales of vermiculite in 1945 reached a new high of 64,808 short tons, 12 percent above the previous record set in 1942. The increase is attributed primarily to the sharp rise in home and industrial building which followed relaxation of Government restrictions on construction. The wider use of exfoliated vermiculite that developed during the war was another factor in the increased output.

Vermiculite is used as a heat and sound insulator in loose form in walls and ceilings and in bonded form in concrete and plaster. It is durable and fireproof, and its light weight puts less load on building frames than do some other materials. Other uses are as an oil absorbent for machine-shop floors, a paint extender, a refractory, and a soil conditioner.

Production in 1945 was reported from five States—Colorado, Montana, North Carolina, South Carolina, and Wyoming. As in previous years, the bulk of the output came from Montana. In Colorado, Erl-ite Mineral Insulation operated in Fremont County and the AleXite Engineering Co., in Gunnison County. The Universal Zonolite Insulation Co. produced in Lincoln County, Mont. Minerals, Inc., which has been producing vermiculite in Macon County, N. C., was reorganized as Vercalite Industries, Inc., and increased its plant capacity. Bee Tree Vermiculite Mines operated in Greenville County, S. C. In Wyoming, Lewis and Martin Smith produced in Converse County, the Mikolite Mining & Development Co. in Carbon County, and the AleXite Engineering Co. in Carbon County. The tonnages and values of screened and cleaned vermiculite shipped in recent years are shown in the accompanying table.

Screened and cleaned vermiculite brings $8 to $12 per short ton at the mine. After it has been exfoliated in the consuming area, it sells for $56 to $100 per ton packaged in 25-pound bags. Loss of weight in exfoliating is estimated at about 10 percent. Assuming an average price of $75 per ton, the total value of exfoliated vermiculite sold in 1945 would be approximately $4,375,000.

Interest in vermiculite is increasing in other countries as well as in the United States. Trade journals described deposits and uses of the mineral in South Africa, and a review including information on location, geology, and production from Australian deposits was published in 1945.[11]

[11] Chemical Engineering and Mining Review, Occurrence of Vermiculite in Western Australia: Vol. 37, No. 436, Jan. 10, 1945, p. 119.

Screened and cleaned vermiculite sold or used by producers in the United States, 1935–39 (average) and 1940–45

Year	Short tons	Value	Year	Short tons	Value
1935–39 (average)	18,486	$180,297	1943	46,645	$471,595
1940	22,299	137,698	1944	54,116	541,744
1941	23,438	125,444	1945	64,808	648,077
1942	57,848	319,931			

WOLLASTONITE

Production and sales of wollastonite in 1945 from the Burnham property near Willsboro, N. Y., exceeded considerably the total of 1944. The property was operated under lease by the Titanium Alloy Manufacturing Co. until November 1, 1945, when it was returned to the estate of J. B. Burnham.

PART IV. MINE SAFETY

EMPLOYMENT AND INJURIES IN THE MINERAL INDUSTRIES

By Forrest T. Moyer

SUMMARY OUTLINE

SUMMARY

Employment in the mineral industries continued to decline in 1945, and the average number of men working daily fell to 639,800. Although the 1945 average number of men was 6 percent below 1944, there was a reversal shortly after midyear of the downtrend in the labor force that had started in 1942. The abrupt termination of war contracts, the closing of munitions, armament, ship-building and other war-fostered industries and the release of men from the armed forces shortly after the end of the Pacific war resulted in an easement of the critical labor shortage which had plagued nearly all mineral industries since 1942. The termination of war contracts also resulted in a decline in demand for some mineral raw materials, as the manufacturing industry of the country entered the period of reconversion to peacetime operations. Reconversion in general proceeded more rapidly and easily than expected until it was retarded by a wave of strikes which further reduced demand for raw materials toward the close of the year. In many mineral industries the monthly pattern of employment through 1945 probably resembled that shown by a monthly series of the average number of men at work daily in bituminous-coal mines. In this series employment declined 3 percent from January to the low monthly total (in months of no strikes) for the year in August and turned upward in September to regain all of the earlier loss by November. The average number of men at work daily in December was slightly lower than in November owing probably to absenteeism before and during the holidays. In those mineral industries in which demand had been restricted by war controls, notably construction materials, the average number of men working daily in 1945 was higher than in 1944, indicating a rapid gain in employment in the closing months of the year. Injury experience of the mineral industries improved over this trying period, and the frequency of all injuries (fatal plus nonfatal) was reduced in 1945 to 55.69 per million man-hours from a frequency of 56.61 in 1944.

Man-hours worked in the mineral industries during 1945 continued the decline that began in 1944. Owing principally to a decreased demand for some mineral raw materials and to two widespread work stoppages in the bituminous-coal industry and one in the anthracite industry, the 1945 total of approximately 1⅓ billion man-hours of productive time was 10 percent below 1944. The time worked in 1945 was lower than in 1944 in each mineral industry group except in nonmetal mines and quarries, for which slight gains were noted. As in man-hours data, the total reported man-days of work for all extractive industries during 1945 fell 10 percent below 1944. Man-days of productive work declined in 1945 in all mineral-industry groups, except in nonmetal mines and quarries, where slightly higher activity was reported.

Salient statistics of employment and injury experience in the mineral industries in the United States, 1942–45, by mineral-industry groups

	1942	1943	1944	1945 [1]
Average number of men working daily: [2]				
Coal mines	530,861	486,516	[3] 457,500	437,000
Metal mines	[4] 99,769	88,039	70,483	62,200
Nonmetal mines	[4] 12,677	[5] 12,713	11,261	12,200
Quarries	84,270	69,877	58,476	59,400
Coke plants	23,909	25,765	24,766	23,100
Metallurgical plants	51,154	[5] 64,735	58,085	45,900
Total	802,640	[5] 747,645	680,571	639,800
Average number of active mine-days: [6]				
Coal mines	243	264	[3] 279	262
Metal mines	[4] 280	294	289	288
Nonmetal mines	[4] 274	[5] 269	282	268
Quarries	271	274	268	264
Coke plants	346	347	351	347
Metallurgical plants	334	[5] 336	329	336
Total	260	[5] 277	286	273
Man-hours worked, in thousands:				
Coal mines	910,389	928,802	[3] 1,001,000	905,000
Metal mines	[4] 223,093	206,704	163,175	143,020
Nonmetal mines	[4] 28,094	[5] 27,999	25,760	26,660
Quarries	180,836	155,280	129,302	130,010
Coke plants	65,222	70,679	69,590	64,080
Metallurgical plants	134,997	[5] 173,633	152,326	119,070
Total	1,542,631	[5] 1,563,097	1,541,153	1,387,840
Number of injuries:				
Fatal:				
Coal mines	1,471	1,451	[3] 1,294	1,079
Metal mines	[4] 215	195	130	104
Nonmetal mines	[4] 22	[5] 25	17	16
Quarries	112	80	73	48
Coke plants	32	17	15	19
Metallurgical plants	29	[5] 31	38	19
Total	1,862	[5] 1,799	1,567	1,285
Nonfatal:				
Coal mines	69,564	64,594	[3] 65,900	59,350
Metal mines	[4] 12,420	11,554	8,909	7,195
Nonmetal mines	[4] 1,537	[5] 1,471	1,283	1,130
Quarries	6,349	5,199	4,437	4,210
Coke plants	921	986	988	815
Metallurgical plants	3,674	[5] 4,666	4,158	3,305
Total	94,465	[5] 88,470	85,675	76,005

See footnotes at end of table.

Salient statistics of employment and injury experience in the mineral industries in the United States, 1942–45, by mineral-industry groups—Continued

	1942	1943	1944	1945 [1]
Injury rates per million man-hours:				
Fatal:				
Coal mines	1.62	1.56	[3] 1.29	1.19
Metal mines	[4] .96	.94	.80	.73
Nonmetal mines	[4] .78	[5] .89	.66	.60
Quarries	.62	.52	.56	.37
Coke plants	.20	.24	.22	.30
Metallurgical plants	.21	[5] .18	.25	.16
Total	1.21	[5] 1.15	1.02	.93
Nonfatal:				
Coal mines	76.41	69.55	[3] 65.83	65.58
Metal mines	[4] 55.67	55.90	54.60	50.31
Nonmetal mines	[4] 54.71	[5] 52.54	49.81	42.39
Quarries	35.11	33.48	34.32	32.38
Coke plants	14.12	13.95	14.20	12.72
Metallurgical plants	27.22	[5] 26.87	27.30	27.76
Total	61.24	[5] 56.60	55.59	54.76

[1] Preliminary figures based upon an average of 75 percent coverage.
[2] The average number of men at work each day the mines were active. Because absenteeism is taken into consideration, this number is lower than the number of men available for work as measured by a count of names on the payroll.
[3] Preliminary figures based upon 75 percent coverage of the industry.
[4] Revised by transfer of figures for fluorspar in Kentucky and Illinois from "Metal mines" to "Nonmetal mines."
[5] Revised figures.
[6] An average in which the operating time of each mine is weighted by the average number of workers in the mine.

As a result of the declining demand for some minerals and the coal strikes, all mineral operations in the country were active an average of only 273 days in 1945, or 13 less than in 1944. The average length of work shift was only slightly changed—from 7.92 hours in 1944 to 7.94 hours in 1945—owing to longer shifts worked in coal, nonmetal, and quarry operations, which more than compensated for shorter shifts worked in metal mines, coke plants, and metallurgical plants. However, employees had a shorter workyear of 2,169 hours in 1945 compared with 2,264 in 1944 because of the fewer days worked in 1945.

The safety of mineral operations continued to improve in 1945, and the over-all attainment, as measured by frequency of injuries per million man-hours of exposure to hazards, was better than in any year since the start in 1931 of complete injury statistics on the mineral industries. The total of 1,285 fatalities to men at work in the mineral industries was lower than in any year since 1933; and for the first time since the series started in 1931, fatalities happened at a rate less than 1 for each million man-hours. The estimated rate in 1945 was 0.93 per million man-hours or slightly lower than the corresponding rate of 1.02 in 1944 and well below the high rate for the period since 1930 of 1.52 in 1932. The estimate for 1945 of 76,005 nonfatal injuries that disabled employees for longer than the day on which the accident occurred was appreciably below the 85,675 nonfatals recorded for 1944 and lower than in any year since 1939. These injuries in 1945 occurred at a rate of 54.76 per million man-hours of work, the lowest rate in the statistical series starting in 1931. However, the improvement in the nonfatal-injury rate in 1945 over 1944 was slight, owing to the greater length of time of exposure in 1944.

The fatality experience was improved in 1945 in all mineral-industry groups except at coke plants. The betterment was most marked at quarries, where the number of fatalities was reduced from 73 in 1944 to 48 in 1945, with a resulting decline in fatality frequency to 0.37 per million man-hours in 1945. At metallurgical plants the number of fatalities was only half that of 1944; but, as man-hours of exposure declined sharply, the fatality rate at these plants in 1945 was reduced

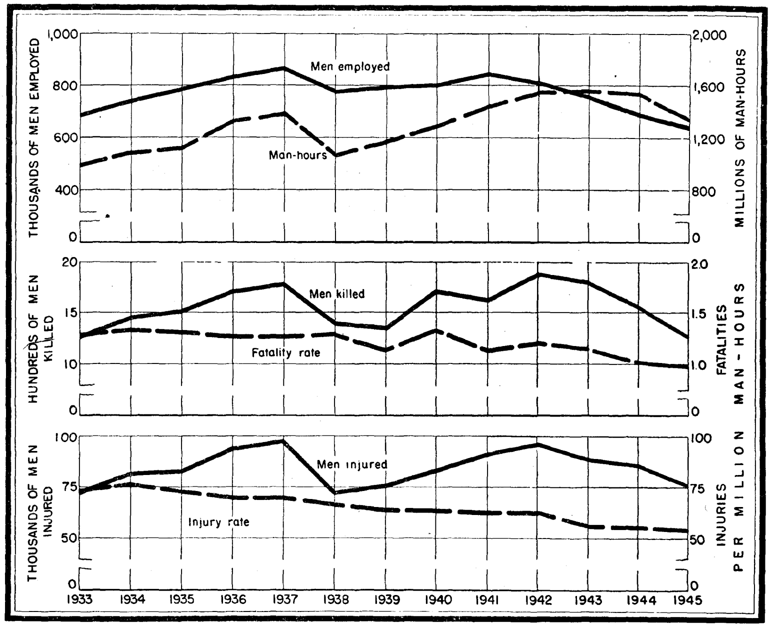

FIGURE 1.—Trends of employment and fatal and nonfatal injuries in the mineral industries of the United States, 1933–45.

to only 0.16 from 0.25 in 1944. Fatalities at coal mines were reduced 215 from 1944 to a total of 1,079, at a rate of 1.19 per million man-hours of working time or a lower frequency than in any other year in a statistical series starting in 1911. The greater number of fatalities at coke plants in 1945, together with the reduced time of exposure, resulted in a 36-percent increase over 1944 in the fatality rate.

The number of nonfatal injuries in 1945 was reduced from 1944 in all mineral-industry groups, and there was an accompanying decline in the frequencies of occurrence for each group except metallurgical plants. However, as man-hours of exposure were well below 1944 in coal mines, metal mines, and coke plants, the decline in frequencies for these groups were not as marked as the reductions in number of injuries. Although there were 6,550 fewer nonfatals in coal mines, the rate of occurrence was only slightly lower in 1945 than in 1944. At metallurgical plants the number of nonfatal injuries declined 853 to a 1945 total of 3,305, which occurred at a rate of 27.76 per million man-hours compared with the 1944 rate of 27.30.

COAL MINES

Injury experience in coal mines was more satisfactory in 1945, and both fatal and nonfatal frequency rates were lower than in 1944. Employment fell to an average of 437,000 men working daily who were exposed to hazards for 905,000,000 man-hours or 10 percent below 1944. These men worked an average of 262 days for an average workyear of 2,071 hours compared with 2,188 in 1944.

BITUMINOUS COAL

Employment.—Manpower was scarce at bituminous-coal mines during the first half of 1945, owing principally to the drafting of men into the armed forces and to the persistent reduction by accidents and retirement of the unexpandable total supply of men available for work in the mines. Results of a monthly canvass of bituminous-coal operations with approximately 75 percent coverage of total production showed an irregular month-to-month downtrend (in months of no strikes) in the average number of men working daily from 369,000 in January to 357,000 in August. From this low point of the year, the average number of men at work increased each month to 369,000 in November, or the same as in January. The average in December fell to 365,000, owing probably to greater than usual absenteeism over the holidays. For 1945, the average number of men working each day the mines were active, totaled 363,000 or 4 percent below 1944.

The estimated output of 576,000,000 short tons of bituminous coal in 1945 was 7 percent lower than in 1944. It was attained despite the reduced labor force and widespread work stoppages in April and October 1945 by operating the mines an average of 261 days, on which the men spent 762,000,000 man-hours of productive work or 9 percent below 1944. The 94,750,000 man-days of work in 1945 declined 10 percent below 1944. The average employee worked 8.04 hours per day compared with 8.00 hours in 1944. The hours of work per year by the average employee totaled 2,099 in 1945, or 109 hours less than in 1944.

The foregoing data on hours and those in the tables relate only to productive work and exclude "travel time" of underground employees and "lunch time" of all employees. The 1943 wage contract of the bituminous-coal industry, which became effective in nearly all parts of the country in November 1943, made portal-to-portal time (except for 15 minutes lunch time) the pay basis for underground workers. In the 1945 wage agreement, which became effective in April 1945, the pay basis for underground men was made total portal-to-portal time by eliminating lunch time through staggering it so as not to interfere with production. With additional data reported by the companies, it has been estimated that complete portal-to-portal time (work time plus actual travel time plus lunch time, whether or not paid for, of underground men and work time of surface men) at bituminous-coal mines in 1945 was 841,000,000 man-hours compared to 927,000,000 in 1944. These portal-to-portal man-hours, which represent the total time of exposure-to-hazard of all employees, yield an average length of shift of 8.88 hours in 1945 and 8.84 hours in 1944.

Injuries.—There was real improvement in the fatality experience in bituminous-coal mines in 1945. It is estimated that the number of men killed in mine accidents in 1945 totaled 936, or 184 fewer than in 1944. These fatalities occurred at a rate of 1.23 per million man-hours of productive work in 1945, an 8-percent reduction from the 1944 rate of 1.33. Although the estimated number of nonfatal injuries was reduced by 5,150 to a total of 47,750 in 1945, the frequency of occurrence of 62.66 per million hours of productive work was only slightly more favorable than in 1944.

In the past, company reports to the Bureau of Mines have included all accidents to underground men, whether or not the accident happened while the man was traveling in or out of the mine or while eating lunch. Combination of this count of injuries with man-hours of productive work resulted in artificially high frequency rates of injuries, as the man-hours of work excluded travel and lunch times and thus did not represent the total time of exposure to hazard. With the portal-to-portal man-hour figures for 1944 and 1945 given in the preceding section on employment, it is possible for the first time to compute true injury-frequency rates for bituminous-coal mines. Fatality rates on a portal-to-portal basis were 1.21 per million man-hours in 1944 and 1.11 in 1945. The rate of occurrence of nonfatal injuries on the same basis was 57.07 per million man-hours in 1944 and 56.78 in 1945. It is notable that the portal-to-portal fatality rates for 1944 and 1945 are, respectively, 9.0 and 9.8 percent and nonfatality rates 9.5 and 9.4 percent below the corresponding work-time rates for the same years.

The 5 major disasters in 1945 killed 68 men, of whom 63 lost their lives in 4 mine explosions and 5 in a roof fall. The explosion disasters occurred as follows: January 17 in an Oklahoma mine, killing 9; March 14 in a Utah mine, killing 7; May 9 in a Utah mine, killing 23; and December 26 in a Kentucky mine, killing 24. The fall-of-roof disaster was on March 12 in a Pennsylvania mine and killed 5 men.

Employment and injury experience at coal mines in the United States, 1941–45 [1]

	Men working daily	Average active mine-days	Man-hours worked	Number of injuries		Injury rates per million man-hours	
				Fatal	Nonfatal	Fatal	Nonfatal
Bituminous-coal mines: [2]							
1941	457,744	214	691,049,388	1,072	46,637	1.55	67.49
1942	448,797	244	772,828,992	1,245	53,193	1.61	68.83
1943	407,135	263	777,970,318	1,225	51,067	1.57	65.64
1944	380,000	276	839,000,000	1,120	52,900	1.33	63.05
1945	363,000	261	762,000,000	936	47,750	1.23	62.66
Pennsylvania anthracite mines:							
1941	88,948	207	130,107,405	194	16,828	1.49	129.34
1942	82,064	239	137,559,994	226	16,371	1.64	119.01
1943	79,381	269	150,832,008	226	13,527	1.50	89.68
1944	77,500	292	162,000,000	174	13,000	1.07	80.25
1945	74,000	267	143,000,000	143	11,600	1.00	81.12
Total coal mines:							
1941	546,692	213	821,156,793	1,266	63,465	1.54	77.29
1942	530,861	243	910,388,986	1,471	69,564	1.62	76.41
1943	486,516	264	928,802,326	1,451	64,594	1.56	69.55
1944	457,500	279	1,001,000,000	1,294	65,900	1.29	65.83
1945	437,000	262	905,000,000	1,079	59,350	1.19	65.58

[1] Data for 1944 and 1945 are preliminary.
[2] Includes lignite.

In 1944 there were 4 major disasters, in which 94 men lost their lives—22 in mine explosions and 72 in mine fires.

Of the 936 fatalities at bituminous-coal mines in 1945, approximately 91 percent were in underground workings, 6 percent in surface work at underground mines, and 3 percent at strip mines. Distribution of the causes of the fatalities was 49 percent from falls of roof and face, 22 percent involving haulage, 8 percent from gas or dust explosions, 4 percent machinery, 2 percent electrical, and the remainder from other causes. Detailed information on the causes of nonfatal injuries is not available; but experience in recent years indicates that the principal causes, in order of frequency of occurrence, are haulage, falls of roof or face, handling materials, machinery, and hand tools.

ANTHRACITE

Employment.—The average number of men working daily at anthracite mines in Pennsylvania declined 5 percent from 1944 to a total of 74,000 during 1945. Although the shortage of labor was less acute at the end of the year, the general scarcity of men that prevailed through most of the year in anthracite as well as in bituminous-coal mining was the principal factor limiting production. Anthracite operations were worked an average (weighted) of 267 days; and, with the available labor force, an aggregate production of 54,400,000 short tons was attained from underground mines, strippings, culm banks, and dredges. This tonnage excludes "bootleg" coal purchased and prepared by recognized producers and was 14 percent below the 1944 output, which was produced with an average of 77,500 men working 292 days. Man-days of work were 13 percent lower than in 1944, but man-hours declined in the slightly smaller proportion of 12 percent owing to the increase in the average length of shift from 7.16 in 1944 to 7.24 in 1945. The average employee at anthracite operations worked 1,932 hours in 1945 compared with 2,090 in 1944.

Injuries.—The total number of fatalities in 1945 is estimated at 143, or 31 fewer than in 1944. The 1945 fatalities occurred at a rate of 1.00 per million man-hours—an improvement over the 1.07 frequency in 1944. Although the number of nonfatal injuries was reduced 1,400 from 1944 to a total of 11,600 in 1945, the frequency of occurrence of 81.12 per million man-hours was less favorable than the corresponding rate in 1944. Of the fatal injuries in 1945, about 91 percent occurred in underground workings, 8 percent in surface works at underground mines (including breakers), and 1 percent at strip mines. The principal causes of fatalities were falls of roof and face, haulage, and explosives.

"*Bootleg holes.*"—"Bootleg holes" are considerably less safe than are operations of "recognized" producers. According to the Anthracite Committee,[1] there were 16 fatalities in "bootleg holes" in 1945. As the estimated total output from these operations was 1,026,000 tons, the fatalities occurred at a rate of 1 for every 64,125 tons mined. In comparison, 380,420 tons were produced per fatality in "recognized" operations during 1945. Although there was a slight improve-

[1] Anthracite Committee, Eighth Survey of Bootleg Holes: Commonwealth of Pennsylvania Dept. of Commerce, Mar. 30, 1946, 8 pp.

ment over 1944, the 1945 fatality experience in "bootleg holes" indicates marked deterioration [2] in safety since 1941, when 103,279 tons were mined per fatality.

METAL MINES

The over-all safety record in metal mines was more favorable in 1945 than in 1944, owing to varying degrees of improvement in each of the industry groups, except the fatality experience at iron mines and the nonfatality experience at gold and silver lode mines and miscellaneous metal mines. The average number of men working daily declined 12 percent from 1944 to 62,200 in 1945 who were exposed to hazard for 143,020,000 man-hours. These men worked an average of 288 days (1 less than in 1944) for an average workyear of 2,299 hours, which was only 16 hours shorter than in 1944.

IRON

All iron-mining operations in the United States are included in this group for the first time, and the 1943 and 1944 statistics have been revised to be comparable. The new classification, in addition to iron-ore mines, includes those operations producing manganiferous and titaniferous iron ores, which formerly had been included in the miscellaneous metal group.

Employment.—Employment at iron mines declined 8 percent from 1944 to 23,700 men working daily in 1945. The reduced force in 1945 worked 288 days in 1945 for a total of 54,710,000 man-hours, which was 7 percent below 1944. The average employee worked an 8-hour shift and had 2,308 hours of work during the year compared to 2,265 hours in 1944.

Injuries.—The 38 fatalities in 1945 (1 less than in 1944) occurred at a frequency of 0.69 per million man-hours, or slightly higher than in 1944. The nonfatal-injury record was slightly more favorable, and the 1,305 injuries in 1945 occurred at a rate of 23.85 per million man-hours compared to 1,412 injuries and a rate of 24.11 in 1944.

COPPER

Employment.—The end of the war had marked effects upon employment at copper-mining operations, and a sharp decline in activity of underground operations was offset only in part by moderately increased activity at open-cuts. The total average number of men working daily declined 20 percent, and man-hours of work fell 23 percent from 1944. As indicated by man-hour data, activity at underground mines in 1945 was about one-third below 1944, whereas at open-cuts it was nearly one-tenth above 1944. The change was due in part to the closing or reduction in operations of some of the higher-cost mines when premium payments on certain operations were reduced by the Federal Government on September 1 and also to the continued scarcity of labor at some of the large underground mining centers. The average employee in copper-mining operations worked a shift of 8.01 hours on the 302 days the mines were active and had a total workyear of 2,416 hours during 1945 compared to 2,523 hours in 1944.

[2] Bureau of Mines, Coal-Mine Fatalities: CMF 175, January 1946, pp. 9–10.

Employment and injury experience at metal mines in the United States, 1943–45, by industry groups [1]

	Men working daily	Average active mine-days	Man-hours worked	Number of injuries		Injury rates per million man-hours	
				Fatal	Nonfatal	Fatal	Nonfatal
Iron mines: [2]							
1943 [3]	30,058	290	70,018,866	48	1,742	0.69	24.88
1944 [3]	25,852	282	58,557,525	39	1,412	.67	24.11
1945	23,700	288	54,710,000	38	1,305	.69	23.85
Copper mines:							
1943	23,700	320	60,689,305	70	3,506	1.15	57.77
1944	18,826	315	47,495,695	38	2,552	.80	53.73
1945	15,100	302	36,480,000	26	1,565	.71	42.90
Lead-zinc mines: [4]							
1943 [3]	20,077	287	45,723,686	49	4,219	1.07	92.27
1944 [3]	16,579	293	38,752,087	41	3,786	1.06	97.70
1945	14,900	294	34,300,000	33	3,240	.96	94.46
Gold-silver mines: [5]							
1943 [3]	4,009	262	8,336,030	9	660	1.08	79.17
1944 [3]	2,783	249	5,529,603	5	403	.90	72.88
1945	2,300	283	5,290,000	2	405	.38	76.56
Gold placers:							
1943	1,398	180	2,019,959	--------	66	--------	32.67
1944	1,287	185	2,022,888	--------	48	--------	23.73
1945	2,100	190	3,280,000	--------	70	--------	21.34
Miscellaneous: [6]							
1943 [3]	8,797	282	19,916,349	19	1,361	.95	68.34
1944 [3]	5,156	259	10,816,716	7	708	.65	65.45
1945	4,100	268	8,960,000	5	610	.56	68.08

[1] Data for 1945 are preliminary.
[2] Includes manganiferous and titaniferous iron ore mines.
[3] Revised figures.
[4] Figures include all lead-zinc mines in the United States for the first time.
[5] Includes only gold-silver lode mines.
[6] Includes antimony, bauxite, chromite, cobalt, manganese, mercury, molybdenum, pyrite, titanium, tungsten, and vanadium-uranium mines.

Injuries.—Over-all injury experience at copper mines improved considerably in 1945, and the fatality and nonfatality rates declined, respectively, to 0.71 and 42.90 per million man-hours. The number of fatal injuries fell from 38 in 1944 to 26 in 1945, and nonfatal injuries declined approximately 1,000 to a 1945 total of 1,565. The sharp changes in activity at underground and open-cut operations, described in the preceding paragraph, undoubtedly were important factors in the much more favorable accident record in 1945.

LEAD-ZINC

All lead-zinc mining operations in the United States are included in this classification for the first time. Formerly, the only statistics available were limited to lead-zinc mines in the Mississippi Valley States, and data on the lead-zinc mines in other States were included in the gold-silver group. To obtain the present grouping, reports on all mines in the gold-silver group were reclassified according to the producers' reports of the principal metal of each mine. Statistics for 1943 and 1944 have been revised to be comparable with the 1945 figures.

Employment.—Employment at all lead-zinc mines in the United States continued to decline and in 1945 fell 10 percent to a total of 14,900 men. Man-hours of work decreased 11 percent from 1944, owing to the scarcity of labor. The average employee worked a shift of 7.82 hours on each of the 294 active mine-days and accumulated a total of 2,302 hours of work during 1945. In 1944 the average shift was 7.96 hours, for 293 active mine-days and a total of 2,337 hours in the average workyear.

Injuries.—The accident record at lead-zinc mines was improved appreciably in 1945, and the frequency of fatalities and nonfatalities declined, respectively, to 0.96 and 94.46 per million man-hours. Owing to the smaller man-hours of exposure in 1945, the decline from 1944 in the number of injuries was in greater proportion than the declines in frequency rates. In 1945 there were estimated to be 33 fatal and 3,240 nonfatal injuries.

GOLD AND SILVER LODE

This classification includes only those mines for which the producers reported gold or silver as the principal metal. Lead-zinc mines outside the Mississippi Valley States, which formerly had been included, have been reclassified in the lead-zinc group. Data for 1943 and 1944 have been revised for comparability.

Employment.—Operations at gold and silver lode mines continued at a low rate in 1945, although the war measure of the Federal Government that closed gold mines in 1942 was revoked, effective July 1, 1945. It is apparent that many gold producers could not recruit labor after July 1, owing to the scarcity of help and other reasons. The average number of men working daily fell to 2,300 or 17 percent below 1944. As the mines operated 283 days in 1945 compared to 249 in 1944, the total man-hours of work declined only 4 percent from 1944. The average length of shift was 8.14 hours, and the average workyear per employee was 2,300 hours in 1945 compared to 1,987 in 1944.

Injuries.—The frequency of fatalities fell to 0.38 per million man-hours in 1945, or less than half the 1944 rate. Only two fatalities occurred in 1945 or three less than in 1944. Although the number of nonfatal injuries was virtually unchanged from 1944, the 1945 frequency of occurrence was less favorable owing to the smaller number of man-hours.

GOLD PLACER

Employment.—Following removal of the ban on operations on July 1, activity at gold placers was expanded appreciably. Both the average number of men at work and total man-hours of work in 1945 were nearly two-thirds greater than in 1944.

Injuries.—The number of nonfatal injuries increased from 48 in 1944 to 70 in 1945; but as man-hours of exposure were sharply higher, the frequency of occurrences of these nonfatals declined to 21.34 in 1945. No fatal injuries were reported at gold placers in 1944 or 1945.

MISCELLANEOUS METAL

Mines producing antimony, bauxite, chromite, cobalt, manganese, mercury, molybdenum, pyrite, titanium, tungsten, and vanadium-uranium are included in this group. Data on manganiferous and titaniferous iron ores have been reclassified in the iron-ore group, and the 1943 and 1944 statistics have been revised for comparability.

Employment.—Employment at the mines in this group continued to fall rapidly, and the 1945 total of 4,100 men was 20 percent below

1944. The decline in man-hours of work was in nearly similar proportions. The average man worked an 8.17-hour shift on the 268 days the mines were active and accumulated a total of 2,185 hours of work during the year compared to 2,098 hours in 1944.

Injuries.—The 5 fatalities in 1945 occurred at a rate of 0.56 per million man-hours—an improvement over the 1944 frequency. Although there were 98 fewer nonfatal injuries in 1945, the rate of occurrence was 68.08 per million man-hours, a less satisfactory record than in 1944.

NONMETAL MINES

Barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral operations are included in this group.

Employment.—Mines in this classification were one of the relatively few segments of the mineral industry in which employment increased in 1945. The average number of men working increased to 12,200, and these men worked 3 percent more man-hours than in 1944. The

Employment and injury experience at nonmetal mines and quarries in the United States, 1943–45, by industry groups [1]

	Men working daily	Average active mine-days	Man-hours worked	Number of injuries		Injury rates per million man-hours	
				Fatal	Nonfatal	Fatal	Nonfatal
Nonmetal mines: [2]							
1943 [3]	12,713	269	27,998,690	25	1,471	0.89	52.54
1944	11,261	282	25,760,287	17	1,283	.66	49.81
1945	12,200	268	26,660,000	16	1,130	.60	42.39
Quarries:							
Cement: [4]							
1943	25,811	299	59,521,298	21	773	.35	12.99
1944	20,605	278	45,753,529	15	637	.33	13.92
1945	21,200	279	48,260,000	10	595	.21	12.33
Limestone:							
1943	21,742	242	45,062,209	31	1,936	.69	42.96
1944	18,182	244	37,810,478	29	1,596	.77	42.21
1945	18,400	234	36,230,000	19	1,415	.52	39.06
Lime: [4]							
1943	10,186	311	25,512,999	15	1,284	.59	50.33
1944	8,653	317	22,341,513	14	1,050	.63	47.00
1945	8,200	311	20,730,000	9	990	.43	47.76
Marble:							
1943	1,540	283	3,699,129		137		37.04
1944	1,450	266	3,324,810	1	102	.30	30.68
1945	1,800	250	3,830,000	2	180	.52	47.00
Granite:							
1943	4,646	243	9,609,421	5	403	.52	41.94
1944	4,278	248	8,953,052	6	385	.67	43.00
1945	4,300	261	9,470,000	5	445	.53	46.99
Traprock:							
1943	2,256	223	4,306,784	4	254	.93	58.98
1944	1,994	229	3,892,117	3	228	.77	58.58
1945	2,100	229	4,080,000		195		47.79
Slate:							
1943	1,255	249	2,676,177		134		50.07
1944	1,071	261	2,386,768	3	146	1.26	61.17
1945	1,200	263	2,800,000		125		44.64
Sandstone:							
1943	2,441	242	4,892,241	4	278	.82	56.82
1944	2,243	261	4,839,658	2	293	.41	60.54
1945	2,200	252	4,610,000	3	265	.65	57.48

[1] Data for 1945 are preliminary.
[2] Includes barite, feldspar, fluorspar, gypsum, magnesite, mica, phosphate rock, rock salt, sulfur, and miscellaneous nonmetallic-mineral mines.
[3] Revised figures.
[4] Includes burning or calcining and other mill operations.

mines were active 268 days, for an average daily shift of 8.16 hours. The number of hours worked per employee during the year was 2,185, or 103 hours less than in 1944.

Injuries.—Injury experience at these operations in 1945 was more favorable, and the number and frequency of both fatal and nonfatal injuries declined from 1944. The 1945 fatality frequency was 0.60 per million man-hours, and the nonfatal rate was 42.39.

QUARRIES

All quarry materials are closely related to construction, and as the end of the war signified early relaxing of the war controls on construction, most of these mineral industries became more active in the latter half of the year. The average number of men working daily increased slightly to a 1945 total of 59,400 men. Man-hours of work also were greater in 1945. An average employee in the quarrying industries in 1945 worked an 8.28-hour shift for 264 days and had a workyear total of 2,189 hours compared to 2,211 hours in 1944. Over-all injury experience was more favorable in 1945, and the number and frequency rate of both fatal and nonfatal injuries were lower than in 1944.

CEMENT

Employment.—The average number of men at work daily in cement quarries and mills advanced to 21,200 in 1945, and these men worked an average of 279 days for 48,260,000 man-hours or 5 percent more than in 1944. The average length of shift was 8.15 hours, and each employee worked an average of 2,276 man-hours during 1945.

Injuries.—Despite the slightly greater activity at cement mills and quarries in 1945, the number of both fatal and nonfatal injuries was reduced from 1944. This resulted in more satisfactory frequency rates in 1945 of 0.21 per million man-hours for fatalities and 12.33 for nonfatalities. There were 10 fatalities and 595 nonfatal injuries in 1945.

LIMESTONE

Employment.—Employment at limestone operations gained slightly over 1944 to reach a total of 18,400 men in 1945. However, man-hours of work declined 4 percent, owing to the reduced number of active days in 1945. The average man worked a shift of 8.41 hours for 234 days and accumulated a total workyear of 1,969 hours.

Injuries.—The safety record at limestone operations was improved over 1944, and the frequency rate of fatal injuries declined to 0.52 and of nonfatal injuries to 39.06 per million man-hours of exposure in 1945. The 19 fatal and 1,415 nonfatal injuries in 1945 were lower in each instance than in 1944.

LIME

Employment.—Reports indicate that 8,200 men were working daily in lime plants and quarries in 1945, a small reduction in labor force from 1944. These men worked an aggregate of 20,730,000 man-hours or 7 percent less than in 1944. The average length of shift was 8.13 hours on the 311 days active, and the average number of hours per man in 1945 was 2,528.

Injuries.—The estimated totals of 9 fatalities and 990 nonfatalities in 1945 occurred at frequencies of 0.43 and 47.76 per million man-hours of work. The rate of fatal injuries was improved in 1945, but for nonfatal injuries the rate was less favorable than in 1944.

MARBLE

Employment.—The down trend in employment at marble quarries which started in 1940 was reversed in 1945, when the average number of men advanced to 1,800. Man-hours of employment were slightly higher than in 1944. The average employee worked an 8.51-hour shift for 250 days and accumulated a total workyear of 2,128 hours in 1945.

Injuries.—The slightly greater activity in marble operations was accompanied by a much less satisfactory safety record than in 1944, and the number and frequency of both fatal and nonfatal injuries were higher in 1945. The 2 fatalities and 180 nonfatalities occurred at respective rates of 0.52 and 47.00 per million man-hours.

GRANITE

Employment.—The number of men working daily at granite quarries was still virtually unchanged, but as these men worked 261 days in 1945 (13 more than in 1944), man-hours of employment gained 6 percent over 1944. The average workyear per employee was 2,202 hours (109 hours longer than in 1944), and the average length of shift was 8.44 hours in 1945.

Injuries.—The reduced number of fatalities in 1945—five—occurred at a frequency of 0.53 per million man-hours, an improved rate over 1944. However, the number of nonfatal injuries increased to 445 and was at the less favorable rate of 46.99 per million man-hours in 1945.

TRAPROCK

Employment.—Available reports indicate that employment at traprock quarries advanced to a total of 2,100 men who worked 4,080,000 man-hours in 1945. The average man worked an 8.50-hour shift on 229 days and had an average workyear of 1,943 hours, which was only slightly lower than in 1944.

Injuries.—The industry was free of fatal accidents in 1945, and the nonfatal injury rate was reduced appreciably to 47.79 per million man-hours. There were 195 nonfatal injuries in 1945 compared with 228 in 1944.

SLATE

Employment.—The number of men working at slate quarries increased to 1,200 in 1945; and, as the quarries were active 263 days, the man-hours of employment showed a corresponding gain over 1944. The average employee worked an 8.86-hour shift and had a workyear of 2,333 hours—104 hours longer than in 1944.

Injuries.—Injury experience improved markedly in 1945. No fatalities were reported, and the reduced number of nonfatal injuries occurred at a rate of 44.64 per million man-hours compared with the corresponding rate of 61.17 in 1944.

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SANDSTONE

Employment.—Employment at sandstone operations in 1945 was changed only slightly from 1944. However, as the 2,200 men worked 252 days in 1945 or 9 days less than in 1944, man-hours of work declined more sharply. The average length of shift was 8.32 hours and the average hours per man per year were 2,095.

Injuries.—The 3 fatalities in 1945 represented a frequency of 0.65 per million man-hours, a less favorable rate than in 1944. However, nonfatal injuries were reduced to 265 and occurred at the improved rate of 57.48 per million man-hours.

COKE PLANTS

The end of the war, the reconversion period, and the year-end strikes in the steel and certain steel-consuming industries combined to relieve some of the pressure on the coke industry in 1945. Fatality experience was less favorable than in 1944, but the nonfatal-injury experience improved.

Employment and injury experience at coke plants in the United States, 1943–45 [1]

	Men working daily	Average active plant-days	Man-hours worked	Number of injuries		Injury rates per million man-hours	
				Fatal	Nonfatal	Fatal	Nonfatal
Byproduct ovens:							
1943	21,632	363	62,652,039	15	611	0.24	9.75
1944	21,586	363	62,848,032	12	752	.19	11.97
1945	20,500	362	59,180,000	18	630	.30	10.65
Beehive ovens:							
1943	4,133	265	8,026,872	2	375	.25	46.72
1944	3,180	267	6,742,049	3	236	.44	35.00
1945	2,600	230	4,900,000	1	185	.20	37.76

[1] Data for 1945 are preliminary.

BYPRODUCT COKE

Employment.—Available reports indicate that 20,500 men—approximately 1,000 less than in 1944—worked 59,180,000 man-hours which was 6 percent below the 1944 figure. The plants were active 362 days and the average employee worked a 7.98-hour shift on these days to accumulate a workyear of 2,887 hours, which was only 25 hours shorter than in 1944.

Injuries.—The fatality record was less satisfactory than in 1944, and the 18 fatal injuries in 1945 occurred at a frequency of 0.30 per million man-hours. Nonfatal injuries were reduced to 630, and these occurred at a rate of 10.65 per million man-hours, an improvement over the 1944 rate of 11.97.

BEEHIVE COKE

Employment.—Employment at beehive plants fell 18 percent to a total of 2,600 men in 1945. As the plants were active only 230 days—37 days less than in 1944—man-hours of work declined 27 percent. The average man worked a daily shift of 8.18 hours and had a total workyear of 1,885 hours or 235 hours below 1944.

Injuries.—The 1 fatal injury in 1945 represented a rate of 0.20 per million man-hours, an improvement over 1944. Nonfatal injuries totaled 185 and had a less satisfactory frequency of 37.76 per million man-hours in 1945.

METALLURGICAL PLANTS

The average number of men working daily at metallurgical plants fell sharply from 1944 to a 1945 total of 45,900, who worked 22 percent fewer man-hours than in 1944. The plants were active 336 days, and the average man worked a shift of 7.73 hours.

ORE-DRESSING PLANTS AND AUXILIARY WORKS

Plants or mills in this group are those in which ores of all metals are processed by the various methods of treatment.

Employment.—Total employment at these plants in 1945 was 15,300, an appreciable reduction from 1944, owing to the scarcity of labor, the smaller tonnages of metallic ores treated, and the closing of some Government-owned ore-dressing mills after the end of the war. Man-hours of work in 1945 declined 19 percent from 1944 owing to decreases for each group of mills.

Employment and injury experience at mills and auxiliary works in the United States 1943–45, by metals

Metal and year	Men working daily			Man-hours worked, in thousands			Injury rates per million man-hours		
	Mill [1]	Auxiliary [2]	Total	Mill [1]	Auxiliary [2]	Total	Mill [1]	Auxiliary [2]	Total
Copper:									
1943	4,409	2,686	7,095	12,370	7,427	19,797	19.48	25.04	21.57
1944	3,494	3,064	6,558	9,642	8,462	18,104	23.96	23.38	23.69
1945 (estimate)	3,200	2,700	5,900	8,500	7,130	15,630	22.00	22.30	22.14
Iron:									
1943 [3]	2,836	546	3,382	5,779	1,421	7,200	15.92	16.90	16.11
1944	2,665	719	3,384	5,251	1,823	7,074	14.66	12.62	14.14
1945 (estimate)	2,500	700	3,200	5,060	1,880	6,940	20.36	4.26	15.99
Gold-silver:									
1943	773	194	967	1,834	478	2,312	56.17	[4] 85.85	62.30
1944	534	89	623	1,186	211	1,397	47.20	75.65	51.51
1945 (estimate)	300	100	400	640	150	790	39.06	66.67	44.30
Lead-zinc:									
1943	3,106	1,742	4,848	7,322	4,248	11,570	32.92	21.19	28.61
1944	3,228	1,957	5,185	8,001	4,798	12,799	40.12	27.72	35.47
1945 (estimate)	2,800	1,300	4,100	6,920	3,120	10,040	52.31	31.73	45.92
Miscellaneous metals: [5]									
1943 [3]	2,132	865	2,997	5,062	2,088	7,150	39.31	51.73	42.93
1944	1,666	716	2,382	3,946	1,721	5,667	36.24	22.66	32.11
1945 (estimate)	1,200	500	1,700	1,950	1,300	3,250	59.49	17.69	42.77
Total:									
1943 [3]	13,256	6,033	19,289	32,367	15,662	48,029	27.06	28.67	27.59
1944	11,587	6,545	18,132	28,026	17,015	45,041	29.54	24.03	27.46
1945 (estimate)	10,000	5,300	15,300	23,070	13,580	36,650	34.37	22.02	29.80

[1] Includes crushers, grinders, washers, ore concentration, sintering, cyaniding, leaching, and all other metallic ore-dressing plants.
[2] Includes maintenance and repair shops, yards, general construction, and other associated works.
[3] Revised figures.
[4] Corrected figure.
[5] Includes antimony, bauxite, mercury, manganese, tungsten, chromite, vanadium, molybdenum, and other metals. Manganiferous iron ore and one titaniferous iron-ore mine have been transferred to iron.

Injuries.—The combined fatal- and non-fatal-injury rate at mills and associated works was less satisfactory than in 1944. Injuries at mills occurred at a frequency of 34.37 per million man-hours in 1945 compared to 29.54 in 1944 whereas the injury record at auxiliary works was at the improved rate of 22.02 per million man-hours compared with 24.03 in 1944. Iron mills and auxiliary works had the best safety record in 1945 and lead-zinc plants had the least satisfactory record of the group.

SMELTERS, REFINERIES, REDUCTION PLANTS, AND AUXILIARY WORKS

Plants in this group are engaged in the primary extraction of nonferrous metals from ores and concentrates and include, among others, smelters, refineries, and reduction, roasting, electrolytic, and retort plants. Iron and steel plants are excluded.

Employment and injury experience at primary smelters, refineries, reduction plants, and auxiliary works in the United States, 1943–45, by metals

Metal and year	Men working daily			Man-hours worked, in thousands			Injury rates per million man-hours		
	Smelter [1]	Auxiliary [2]	Total	Smelter [1]	Auxiliary [2]	Total	Smelter [1]	Auxiliary [2]	Total
Copper:									
1943	10,153	5,731	15,884	28,533	16,012	44,545	20.01	14.61	18.07
1944	7,728	4,505	12,233	21,733	12,925	34,658	24.20	11.61	19.50
1945 (estimate)	7,200	3,800	11,000	19,860	10,920	30,780	20.49	16.03	18.91
Lead, silver-lead:									
1943	2,226	1,363	3,589	5,856	3,560	9,416	25.62	17.14	22.41
1944	2,175	1,273	3,448	5,715	3,345	9,060	19.95	8.37	15.67
1945 (estimate)	2,100	1,200	3,300	5,570	2,900	8,470	20.47	9.31	16.65
Zinc:									
1943	6,869	3,997	10,866	19,429	11,339	30,768	38.29	22.75	32.57
1944	7,227	3,466	10,693	20,497	9,623	30,120	36.20	24.84	32.57
1945 (estimate)	6,600	3,300	9,900	18,460	9,270	27,730	36.02	21.68	31.23
Miscellaneous metals: [3]									
1943 [4]	10,262	4,845	15,107	27,751	13,125	40,876	37.51	23.85	33.12
1944	8,929	4,650	13,579	22,137	11,309	33,446	37.72	28.74	34.68
1945 (estimate)	3,100	3,300	6,400	7,260	8,180	15,440	59.50	25.18	41.32
Total:									
1943 [4]	29,510	15,936	45,446	81,569	44,036	125,605	30.72	19.67	26.85
1944	26,059	13,894	39,953	70,082	37,202	107,284	31.63	19.95	27.58
1945 (estimate)	19,000	11,600	30,600	51,150	31,270	82,420	31.63	19.48	27.02

[1] Includes smelters, refineries, and reduction, roasting, electrolytic, retort, and all other plants producing nonferrous metals.
[2] Includes maintenance and repair shops, yards, general construction, and other associated works.
[3] Includes mercury, antimony, tin, and magnesium plants.
[4] Revised figures.

Employment.—Employment and man-hours of work at these plants and their associated works declined, owing to the closing of Government-owned plants before and after the end of the war and to the general shortage of labor. The total number of men and the man-hours of work both declined 23 percent from 1944. Of the 30,600 men working in 1945, approximately two-thirds were employed in the smelters or refineries and the remainder in the auxiliary works.

Injuries.—Injury experience (fatal plus nonfatal) in these plants was slightly more favorable than in 1944, owing to an improved rate of occurrence in auxiliary works. The frequency of injuries in smelters was unchanged from 1944 at 31.63 per million man-hours. In the group classed according to the metal produced, the injury record was more favorable in 1945 in the copper and zinc plants and less favorable in the lead and miscellaneous metal plants. Injuries occurred less frequently in lead plants and most frequently in the miscellaneous metal plants in 1945.

PART V. FOREIGN MINERALS

FOREIGN MINERALS REVIEW

SUMMARY OUTLINE

GENERAL SUMMARY

By J. S. McGrath

By the close of 1945 evidence was ample that reconversion of the world economy from a wartime to a satisfactory peacetime basis could be brought about only through political decisions on certain fundamental issues that were discussed by the Council of Foreign Ministers at London in September and at Moscow in December. Issues requiring primary consideration by all nations, and particularly by the powers represented on the council, were (1) recognition of the menacing consequences of the atomic bomb on the relationships of all States, (2) cooperation of the nations for the solution of world economic problems as provided in the Charter of the United Nations, (3) unification of control for the whole of Germany and the former Japanese Empire, (4) exaction of reparations from the former Axis powers and agreement as to the form and volume of the reparations, and (5) determination of the future industrial capacity of Germany, Japan, and Italy. Although discussions on these basic issues continued throughout the year, no decisions were reached.

Minerals, either directly or indirectly, are involved in each of the five aforementioned basic issues, principally because the political, economic, and social welfare of the industrial nations depends to a marked degree on their mineral supplies; this was quite clearly demonstrated by the adverse effects of postwar shortages of coal and fertilizers on the population of every country in Europe and on those of China and Japan. These effects, in addition to others of similar character, have made evident the urgent need for international cooperation through an agency such as the United Nations organization if the hazardous results of mineral deficiencies are to be avoided and the adoption of restrictive trade policies and objectionable private international commodity agreements is to be forestalled.

Of primary importance in connection with the necessity for a functioning international organization is the subject of atomic energy. This energy of the future—and probably of the not very distant future—poses a new problem for the world, one which, for the present at least, is basically mineral in character. Within a relatively short time, reserves of mineral fissionable materials will in all probability be the most important factor in a nation's development of atomic power for peacetime industrial uses. Industrial atomic power, when it comes, however, will compete with power derived from two other minerals, coal and petroleum, and this competition among the several power-producing minerals is certain to influence materially the economic status of many countries and their populations.

The near future of many of the nations of the world, as indicated above, today probably depends more on mineral assets than at any time in the past. The following sections of this chapter have been prepared with that fact in mind; the data they contain indicate clearly the interdependence of the nations for minerals and the critical need for an international body to effect their equitable distribution.[1]

[1] A few discrepancies exist between the foreign statistics in some of the commodity chapters and the statistics presented in this chapter inasmuch as the latter are based in part on new and revised information received from abroad, subsequent to the preparation of the commodity chapters.

BRITISH DOMINIONS OF NORTH AMERICA

By Frank L. Fisher

CANADA

Canada's mineral production was valued at $479,587,911 in 1945 compared to $485,819,114 in 1944.[2] Fuels and metals decreased in value for the year, while nonmetallics and structural materials showed increases. Gold production dropped 10 million dollars in value from the previous year, for a total of $102,000,000. Copper and nickel decreased in value and quantity, while a decreased production of zinc had a higher value than 1944. Lead production increased in quantity and value over the previous year, and iron-ore production was doubled. Coal production dropped about 300,000 tons from 1944, and oil production was down 1.5 million barrels. Natural gas increased about 6,000,000 thousand cubic feet. In the nonmetallic minerals group, gains over 1944 were noted for asbestos, barite, feldspar, graphite, gypsum, magnesitic dolomite, and nepheline syenite; but salt, quartz. sodium sulfate, and sulfur showed a decrease. In the structural materials group, gains over 1944 were reported for production of clay products, cement, and sand and gravel; but limestone and stone decreased.

Ontario continued to be the major mineral-producing province, with an annual value of production in 1945 of $199,807,489, or 41.66 percent of the Dominion total. Quebec was next, with 18.51 percent of the production value, and British Columbia and Alberta had 13.28 and 10.72 percent, respectively. The only marked increase in value of mineral production over 1944 was reported for British Columbia with a gain of 1.40 percent.

Copper.—Production of refined copper in 1945 decreased for the fourth consecutive year, and amounted to 227,486 tons valued at $59,499,670. The 1945 mine production was 238,142 tons. Ontario remained the largest producer, with 118,174 tons, and Quebec had 53,819 tons as the second ranking Dominion producer. An extensive exploration program was conducted during the year by the Quemont Mining Corp., Ltd., on a copper-gold-silver deposit, adjoining the property of Noranda Mines, Ltd., in the Rouyn area of Quebec.

Gold.—Gold production in 1945 dropped 261,344 ounces for a total of 2,661,567 ounces for the year. Ontario produced 1,590,339 ounces, followed by Quebec with 664,226 ounces for the year and British Columbia with 188,380 ounces. The gold-mining industry showed an improved outlook after years of war, and general expansion began with the lifting of restrictions. Increased activity in exploratory work was noted, especially in Quebec, Ontario, Manitoba, and the Northwest Territories.

Iron ore.—Production of iron ore in 1945 totaled 1,134,808 tons, a sharp increase from the 553,252 tons produced in 1944. Iron-ore shipments were made in 1945 from the New Helen mine of Algoma

[2] All references to dollars are in terms of Canadian dollars. The official buying rate for drafts on New York throughout 1945 was 1 Canadian dollar equaled 0.90909 American dollar. Canadian statistics are reported in short tons, unless otherwise indicated.

Ore Properties, Ltd., in the Michipicoten area of Ontario, and the Steep Rock mines near Atikokan, Ontario. Exploratory work continued during the year in the Michipicoten area of Ontario and on the reportedly large iron-ore deposits in the Sawyer Lake region along the Quebec-Labrador boundary. The four Canadian steel companies produced a normal 1,777,958 tons of pig iron and 2,881,323 tons of finished steel during 1945.

Lead.—The increased demand for lead resulted in a production in 1945 of 172,728 tons, which was 20,437 tons over 1944.

Nickel.—Nickel production in 1945 was 121,978 tons, a decrease from the 137,299 tons produced in 1944. Virtually the entire production continued to come from the plants of the International Nickel Co. of Canada, Ltd., and the Falconbridge Nickel Mines, Ltd., both near Sudbury, Ontario. The Falconbridge Co. resumed matte shipments in 1945 to its refinery at Kristiansand, Norway.

Platinum group.—Production of platinum from copper-nickel ore was 162,000 ounces in 1945, a slight increase over 1944. Production of the other platinum-group metals was 155,600 ounces for 1945.

Silver.—Silver production continued a 6-year decline, with a total of 12,866,597 fine ounces in 1945. The decrease was 760,512 fine ounces less than the 1944 production and a drop of 10,967,155 fine ounces from the 1940 production. British Columbia continued to be the principal producing Province.

Zinc.—The mine production of zinc in 1945 continued to decrease, with a total for the year of 254,819 tons—a drop of over 20,000 tons from 1944. British Columbia continued to be the major Provincial producer.

Other metals.—The production of cobalt, bismuth, cadmium, and selenium showed a marked increase during 1945, while production of arsenic, chrome, magnesium, antimony, molybdenite, and ilmenite decreased sharply. Mercury, manganese, and tungsten were not produced in the Dominion on a commerical basis during 1945. Tin production from tailings of the Sullivan mine was 425 tons for the year.

Other nonmetallic minerals.—*Asbestos* production in 1945 was 460,051 tons compared to 419,265 tons for 1944. The bulk of the production was exported in the unmanufactured state to the United States. The 1945 production was valued at $21,405,391. Production of *barite* continued to increase sharply, amounting to 140,198 tons in 1945. The bulk of the production came from the plant of the Canadian Industrial Minerals, Ltd., at Walton, Hants County, Nova Scotia, and from Parson, near Golden, British Columbia. Production of *sulfur* as a byproduct of smelters and refineries increased slightly during the year, for a total production of 245,859 tons. *Salt* production from all sources decreased several thousand tons for a 1945 total of 678,004 tons.

Sodium sulfate production dropped sharply during the year to 86,643 tons. *Talc and soapstone* production decreased slightly in 1945. *Quartz* production continued to decline with a production for 1945 of 1,458,847 tons. *Nepheline syenite* production continued to increase, with a 1945 total of 60,133 tons coming solely from Lakefield, in Peterborough County, Ontario. *Mica* production continued at an accelerated rate during the year, with a production of 7,369,964 pounds of all grades. Production from the exceptionally rich deposits in the Eau Claire area, Ontario, decreased considerably during 1945. Production of *magnesitic dolomite and brucite* showed a slight increase in 1945, with the bulk of the production quarried and processed at Kilmar and Harrington East, Argenteuil County, Quebec, and Wakefield, Quebec. The 1945 sales of *gypsum* were 822,380 tons compared to 596,164 tons for 1944, but the industry was still far short of the prewar normal. The 1945 production of *graphite* from the Black Donald mine, Renfrew County, Ontario, the only producer, was 1,840 tons. Minor production in 1945 was reported for *feldspar*, *fluorspar*, *corundum*, *ocher*, *phosphate rock*, *quartz rock*, and *sodium carbonate*.

Fuels.—*Coal* production dropped to 16,457,000 tons, reflecting a steady decline since 1942. The 1944 production was 17,026,499 tons. Alberta continued to be the largest producer, with 7,829,468 tons, followed by Nova Scotia and British Columbia, with 5,232,667 tons and 1,711,182 tons, respectively. *Natural-gas* production increased from 45,067,158 thousand cubic feet in 1944 to 50,794,000 thousand cubic feet in 1945. The Turner Valley field in Alberta continued to have primary importance. *Crude petroleum* production dropped in 1945 to 8,550,000 barrels, from 10,099,404 barrels in 1944. Ninety percent of the Canadian production comes from the Turner Valley field in Alberta, which had an output of 8,039,000 barrels in 1945. The discontinuance of operations on the Canol project at Norman Wells in 1945 accounted for much of the drop in Canadian production. The project operated from May 1942 to March 1945 and produced 1,858,447 barrels from a recoverable reserve, estimated in 1945, of 36,250,000 barrels. A new field, the Lloydminster of Saskatchewan, began producing in the spring of 1945.

Clay products and other structural materials.—The value of *clay products* increased sharply from 6,997,425 Canadian dollars in 1944 to 8,385,185 Canadian dollars in 1945. *Cement* production also increased to 1,330,116 tons in 1945 compared to 1,141,594 tons for the previous year. Production of *lime* decreased slightly during the year to 831,982 tons. *Sand and gravel* production increased slightly to 29,021,249 tons, and *stone* decreased to 5,884,718 tons.

NEWFOUNDLAND

The mineral industries of Newfoundland had another year of continued prosperity in 1945.[3] Production increases were noted for iron ore and copper, lead, and zinc concentrates.

Iron-ore production from the Wabana mines was approximately 1,000,000 tons in 1945. No new iron ore deposits were reported, but continued exploration on known deposits in Labrador indicated that they were larger than first anticipated and would rank among the world's largest iron-ore deposits. The Buchans mine increased production in 1945 to 1,200 tons of ore per day compared to 1,000 tons in 1944. The 1945 production was 24,251 tons (3,365 tons copper content) of copper concentrate, 32,352 tons (22,608 tons lead content) of lead concentrate, and 75,096 tons (49,350 tons zinc content) of zinc concentrate.

[3] Sanderhoff, L. O. (American vice consul), Newfoundland's Economy—1945 (Mining and Geological Survey section by Consul R. J. Cavanaugh): State Department Dispatch 15, St. Johns, Newfoundland, Mar. 13, 1946, 37 pages.

MIDDLE AMERICA[4]

By Sumner M. Anderson

BRITISH WEST INDIES

Mineral production in the British West Indies is confined to asphalt and petroleum in important quantities and to limestone and lime, salt, and phosphate rock.

Bahamas.—In addition to sufficient limestone plus conch shells to produce approximately 1,700 metric tons of lime, about 500 tons were quarried for use in domestic construction. Total limestone quarried and calcined in 1945 was virtually the same as in 1944. West India Chemicals, Ltd., extracted 38,825 metric tons of salt from sea water, compared with 60,960 tons in 1944.

Although no petroleum production has yet been established in the Bahamas, concessions totaling 47,309 square miles of land and offshore waters have been granted by the government to one local, three American, and three British oil companies, and exploration on a large scale was begun in 1945. Location for the first test was staked in November by Bahamas Oil Co., Ltd. (Superior Oil Co. of California), at the approximate center of the northern end of Andros Island. Exploration elsewhere includes seismograph operations in the Bimini Islands and a gravity survey on Grand Bahama Island.

Barbados.—Small local industry on Barbados regularly produces limestone and lime, sandstone, sand, and earth for domestic consumption in quantities that are not reported. Salt has not been produced since 1941. A variety of asphalt known as manjak is mined for export to the United States; output amounted to 33 metric tons in 1944, but only 9 tons in 1945. Production of crude petroleum by the British Union Oil Co. dropped steadily from 3,737 barrels in 1939 to 652 barrels in 1944; in 1945, continued bailing from shallow wells yielded 1,738 barrels, all of which was refined locally, as usual, to supplement essential imports. Natural gas valued at £2,025 was sold from the same field in 1945.

Bermuda.—No record is kept of the limestone and lime produced annually, for local use only, on the island of Bermuda.

Jamaica.—Limestone is quarried in many places on the island of Jamaica for various domestic purposes, including the calcining of lime; but no tonnage record is available, and none of the stone is exported. During 1945 a British firm was granted a franchise to manufacture cement near Port Henderson, but local opposition to the terms has held up the project.

Both the Reynolds Metals Co. and Jamaica Bauxites Ltd. (Aluminum Co. of Canada, Ltd.) acquired options to extensive bauxite deposits, following examination started in 1942. Some additional prospecting was done, but commercial development has been postponed; pending adoption of a proposed mining code for Jamaica.

Turks and Caicos Islands (Jamaica Dependencies).—This island group has only one important industry; it is the largest producer and

[4] Unless otherwise indicated, statistics for all Middle America countries are in metric tons.

exporter of salt in the British West Indies. The drop in production from 33,779 metric tons in 1944 to 21,229 tons in 1945 was brought about by the hurricane of September 1945, which wrecked the salinas and destroyed extensive Government-owned stocks. Rehabilitation of the industry was initiated by the Government in November.

Cayman Islands (*Jamaica Dependencies*).—Phosphate-rock production, revived on a very small scale during 1942–44, dwindled to insignificance in 1945.

Trinidad.—Limestone production amounted to 617,350 metric tons in 1945 compared with 599,581 tons in 1941, with the intervening years not reported. Production of natural asphalt from the famous Trinidad lake, unreported during the war years 1942–44, dropped from 81,753 metric tons in 1941 to 29,462 tons in 1945. Security regulations surrounding the oil industry during the war have been lifted, revealing the following production figures for crude petroleum, in barrels: 1941—20,505,980; 1942—22,069,178; 1943—21,385,240; 1944—22,138,502; 1945—21,092,608. Of the 16 Trinidad fields, Forest Reserve and Francique on the Fyzabad structure supply nearly half the island's output at present and have yielded well over half of the cumulative total of 317,966,315 barrels through 1945. New developments during the year included a submarine concession granted to the Trinidad Petroleum Development Co., Ltd., to explore an area off the south coast.

Trinidad Leaseholds, Ltd., owns 60.0 of the 74.3 miles of pipe lines that distribute crude petroleum from fields to refineries and has joint interest with Siparia Trinidad Oilfields, Ltd., and Trinidad Central Oilfields, Ltd. in the remainder. Refinery capacity exceeds crude production, and virtually all of the crude is refined on the island. Exports of refinery products amounted to 17,208,745 barrels in 1945 (16,461,494 barrels in 1944).

CUBA

In 1945 the United States Geological Survey completed large-scale investigations of Cuban minerals and mining methods which had been started in 1940 and which had contributed materially to the development of mineral resources—particularly manganese ore and chromite—during the war years. With the end of the war, however, the United States Commercial Company discontinued its strategic minerals purchase program, and Cuban production of chromite, manganese ore, and barite declined abruptly. Production of copper, which responded to the discovery of new reserves, and of nickel oxide, which did not start until December 1943, increased substantially.

METALS

Chromite.—Production of refractory-grade chromite in the Camaguey and Punta Gorda areas was held at a high level during the first three quarters of the year but dropped enough in the fourth quarter to bring the year's total down to 161,612 metric tons, compared with 173,220 tons in 1944. Four producers, Cía. Cubana de Minas y Minarales, S. A., Juragua Iron Co., Minera Moa, S. A., and Primativo Portal, supplied the total output. Metallurgical-grade chromite was mined on a reduced scale all year, and the combined output of Mayarí

Mining Co., S. A., Miranda-Gasset, and Landa y Asencio amounted to only 11,014 metric tons, a 42 percent drop from the 1944 figure of 18,911 tons.

Copper.—Minas de Matahambre, S. A., the only copper company now active in Cuba, started development of its newly found reserves and boosted total production of copper-in-concentrates from 6,584 metric tons in 1944 to 9,067 tons in 1945. Further improvement is expected in 1946.

Iron.—The mining of iron ore in Cuba, which dropped from 192,851 metric tons in 1941 to 28,370 tons in 1944, ceased before the close of the latter year. The mines are owned by the Juragua Iron Co.; extensive reserves remain undeveloped, but the company has been unable to maintain the uniform ore composition demanded by steel makers.

Manganese.—Manganese-nodule production declined from 135,638 metric tons in 1944 to 132,317 tons in 1945. Production of ore other than that used for sintering dropped from 122,226 tons in 1944 to 65,676 tons in 1945. Resultant total output of ore carrying 45 percent manganese or better was 257,864 metric tons in 1944, 197,993 tons in 1945. Ores suitable for sintering are disappearing rapidly, and a further decrease in total output is expected in 1946. Most of the 50 or more mines operating in the first quarter of 1945 were closed down indefinitely during the latter half of the year, leaving an estimated 3,500 workers without employment.

Nickel.—The Nicaro Nickel Co. attained full operating capacity of its United States Government-sponsored nickel oxide plant in Oriente Province by the end of 1945. A total of 14,152 metric tons of oxide containing 10,940 tons of nickel was produced, as against 6,260 metric tons of oxide containing 4,679 tons of nickel in 1944. (Nickel-content figures include unreported quantities of cobalt.) Recovery of oxide from ore was improved during the year, and is hoped to be improved further as experimental work is continued. Profitable operation of the plant on a competitive basis is yet to be demonstrated.

Tungsten.—The Pan American Tungsten Corp. reopened its Lela mine (closed in 1943) on the Isle of Pines in 1945 but suspended operations before the end of the year after having extracted 9 metric tons of 60-percent WO_3 concentrates.

Precious metals.—Production of gold and silver has never been important in Cuba and was not reported in 1945. United States imports from Cuba, however, amounted to 423 troy ounces of gold and 107,195 ounces of silver, mostly contained in copper concentrates from the Matahambre mine. Renewal of gold mining early in 1946 on the Isle of Pines has been reported.

NONMETALLIC MINERALS

Barite.—To complete a contract made in 1944 with the United States Commercial Company, 2,094 metric tons of barite was quarried in 1945 at Amelia (west of Pinar del Rio) and processed at the grinding plant of Mineral Products Corp. at Regla, Habana. Output of the same company amounted to 4,787 metric tons in 1944.

Cement.—La Cía. Cubana de Cemento Portland operates the only cement plant in Cuba on Mariel Bay, about 30 miles west of Habana. Production, which has been mounting steadily since 1940, attained a new peak of 180,166 metric tons (1,059,800 barrels) in 1945, as against 173,750 tons (1,022,060 barrels) in 1944 and was supplemented by imports of 81,354 metric tons (477,000 barrels), compared with 57,818 tons (339,000 barrels) in 1944; but demand, based on a continued construction boom that began about 1937, still exceeded the supply. Indicated consumption amounted to 261,520 metric tons (1,536,800 barrels) in 1945 and 231,568 tons (1,361,060 barrels) in 1944.

Diamonds.—Although diamonds are not mined in Cuba, a cutting industry established by European refugees during the war grew to 28 factories employing 1,500 workers at the end of 1944. On May 1, 1945, controls over the local diamond industry, which had been confined to imports to and exports from the United States, were relinquished through the American Embassy at Habana. As a result the industry broadened; rough diamonds have been received from England and cut stones exported to Mexico, and by the close of the year the number of factories had expanded to 52, employing 3,500 workers, although production was retarded by labor difficulties during the first quarter. Moreover, the quality of workmanship is said to have improved during the year, but full competition from the prewar production centers has not yet been felt, and the future of the Cuban branch of the industry is, therefore, still uncertain. Total imports of rough stones, amounting to 201,983 carats valued at $2,543,000 in 1944, have not been reported for 1945. Total exports of cut and polished diamonds since the industry started have been as follows:

Cuban exports of diamonds, 1942–45

Year	Carats	Value, f. o. b. Habana	Value per carat
1942	2, 590. 44	$297, 668. 54	$114. 91
1943	22, 190. 21	3, 292, 011. 45	148. 35
1944	67, 959. 80	10, 164, 630. 19	149. 57
1945	59, 894. 00	9, 950, 728. 00	166. 14

Other nonmetallic minerals.—Reported 1945 production of other industrial minerals in metric tons, compared parenthetically with 1944, included calcined gypsum, 2,974 (4,061); magnesite, none (86); and marine salt, 63,504 (15,422). Production of lime, stone, sand, gravel, clay, and pigment earths was not reported quantitatively.

HYDROCARBONS

Asphalt.—The reported estimate of 9,070 metric tons of asphalt produced in 1945 is believed to apply only to gilsonite, sold chiefly in export. Another type of asphaltite averaging up to 20 percent ash is mined and used locally for fuel, although production may have diminished since the lifting of war restrictions on fuel imports. Overall production of asphalt in 1944 amounted to 40,000 metric tons.

Petroleum.—Production of naphtha (natural gasoline) in the Motembo field dropped from 94,171 barrels in 1944 to an estimated

55,900 barrels in 1945, continuing the steady decline from the peak year 1941, while that of natural-gas oil in the Jarahueca field increased to an estimated 87,600 barrels in 1945, compared with 14,831 barrels in 1944 and 3,825 barrels in 1943, the first year of production. The two fields yielded a combined production estimated at 143,500 barrels of liquid fuel, for a net increase over the 109,002 barrels in 1944. The Bucuranao field has yielded no crude petroleum since 1943 and is said to be exhausted. Results of test drilling by Standard Oil Co. of Cuba and the Estrella Co. (Shell and others) in 1945 reportedly were more promising than during the previous year but were unproductive.

The natural-gas oil from the Jarahueca field was treated by the three small refineries of the Union Oil Co. at Bucuranao, Destiladora de Jarahueca, and Petrolera de Jarahueca at Jarahueca, yielding gas oil, gasoline, kerosine, fuel oil, and residue.

DOMINICAN REPUBLIC

Gold.—Exports of gold continued the steady decline from 1941 and reached a new low of 486 troy ounces in 1945. Beginning in 1946, exports can no longer be regarded as an index of production, as most of the output is to be added to a Government reserve as a guarantee for Dominican currency, when and if such currency is issued, and few future exports are contemplated. A Government contract, granted November 15, 1944, and revised December 3, 1945, has given to an American geologist an exclusive gold-mining concession covering five provinces for a period of 3 years, and introduction of dredging methods are being considered.

Bauxite.—Culminating 2 years of field work, the Alcoa Exploration Co. announced the discovery of 6,000,000 tons of low-grade bauxite in central Barahona and on April 2, 1945, obtained a mining concession from the Government. The Reynolds Metals Co. has withdrawn from similar exploration, at least temporarily, to concentrate its field work on bauxite deposits in Jamaica.

Cement.—Construction of the Dominican Republic's first cement plant near Ciudad Trujillo, started in 1944 by the Foundation Co. of New York, progressed during the year and is expected to be completed and the plant in operation during the last half of 1946.

Gypsum.—In 1945, 3,258 metric tons of gypsum were produced by Salinera Dominicana from mines 25 miles north of Barahona, compared with 2,146 tons in 1944. Total output is exported to Puerto Rico for use in the Ponce and San Juan cement plants. Future production may be expected to increase to meet domestic requirements exclusively when the cement plant near Ciudad Trujillo goes into operation.

Lime.—About 25,000 metric tons of lime are produced annually in Dominican Republic in a primitive beehive system of ovens. A large part of the production and about 85 percent of the consumption are accounted for by the sugar industry; 15 percent is used in construction.

Salt.—Estimated salt production in 1945 amounted to 2,650 metric tons derived from the evaporation of sea water and 12,450 tons dug from the Barahona mines, making a total of about 15,100 tons, or

3,800 tons more than the amount estimated for 1944. The profitable salt concession has been held, up to date, by Salinera Dominicana, C. por A. (President Trujillo, owner), but will be taken over in 1946 by the Banco Agricola, which is controlled by the Banco de Reservas de la Republica Dominicana (President Trujillo, majority stock holder). Both sea salt and rock salt are included in the terms of the concession. Exports of salt are negligible.

Petroleum.—Exploratory work by Seaboard Dominicana, a subsidiary of Standard Oil Co. of New Jersey, was closed down during 1945 for lack of heavy drilling equipment, which has since been received. Drilling on the shores of Lake Enriquillo was expected to start in February 1946.

FRENCH WEST INDIES

There is no known mineral industry in the French West Indies.

HAITI

Gold.—Purchase of placer gold by the Banque National de la Republique d'Haiti amounted to 161 troy ounces in 1944; the amount recovered but unreported or smuggled out of the country is unknown. Production in 1945 has been officially estimated at "500 to 1,000 ounces," but the estimate is believed to be high, as only 73 ounces were imported into the United States from Haiti during the year.

Bauxite.—The Reynolds Mining Co. continued examination and development of its bauxite deposits in the Ste. Croix area and shipped about 300 tons of bauxite to the United States for experimental purposes. The Reynolds contract with the Haitian Government calls for active exploitation of its concession after August 4, 1946, and plans are being made to start active operations on or before that date.

Salt.—Recovery of crude salt from sea water, for domestic use only, continued in 1945 at approximately the average annual rate of 8,000 tons.

Building material.—Small local industry in Haiti regularly produces lime, common brick, and some building and construction stone, but in amounts that are not reported.

Petroleum.—The Atlantic Refining Co. completed two test wells, 47 and 50 miles north-northeast of Port-au-Prince in the Jurinat area, with negative results. Exploration work was continued in the Cul-de-Sac Valley.

NETHERLANDS WEST INDIES

Phosphate.—Natural phosphate of lime amounting to 8,770 metric tons was mined at Newport and exported from the island of Curaçao in 1945, compared with 7,813 tons in 1944. Mining ceased, however, in the latter half of the year and is not expected to be resumed, unless a market such as existed in prewar years reopens in Denmark and Sweden.

Salt.—Shipments of marine salt dropped from 5,150 metric tons in 1944 to 3,109 tons in 1945, of which 2,635 tons were exported from the island of Bonaire, 330 tons from St. Martin, and 144 tons from St. Eustace.

Petroleum.—The quantities of Venezuelan and Colombian crude petroleum treated in the great refineries of Aruba and Curaçao during the war years have recently been revealed as follows, in thousands of barrels: 1939—142,850; 1940—116,780; 1941—148,332; 1942—110,315; 1943—145,776; 1944—190,040; 1945—not yet reported. An important byproduct contribution to the steel requirements of the United Nations during these years was the collection of vanadium-carrying residues from boiler plants, refinery furnaces, and ships that burn Venezuelan fuel oil.

MEXICO

Four of the principal ores and metals of Mexico—pig iron, lead, copper, and cadmium flue dust—reversed the production trends of 1944 and registered increased output in 1945. Twelve other items in this grouping decreased in proportions ranging from 1.9 to 60.1 percent relative to 1944. Except for mica, nonmetallic minerals and fuels fared much better; production of petroleum, coal, and strontium minerals rose, and that of graphite and crude sulfur appears to be the highest on record. The general recession in metallic mining, except for the metals cited, reflects the relaxation of demand in the United States following the close of the war, and Mexico is now looking to reopening of some of the Latin American and European markets that have been closed for the past 6 years. The industry is also feeling the influence of Government policy, as reflected in the present laws regulating taxation and conditions of labor,[5] and difficulties that have arisen in transportation.

The following table presents a comparison of production reported for the past 2 years.

Summary of mineral production of Mexico, 1944–45 [1]

[Metric tons, except as otherwise indicated]

Mineral	1944	1945	Difference (percent)
METALLIC ORES AND METALS			
Antimony (contained metal)	10,930	8,754	−19.9
Arsenic oxide (white arsenic)	15,306	15,013	−1.9
Bismuth kilograms	165,379	161,368	−2.4
Cadmium, in flue dust do	682,295	1,052,766	+54.3
Copper	41,300	61,680	+49.3
Gold troy ounces	508,882	499,301	−1.9
Iron ore	186,961	175,165	−6.3
Iron, pig	134,632	208,148	+54.6
Lead (content of ore mined)	185,281	205,315	+10.8
Manganese ore, Mn content	29,070	18,542	−36.2
Mercury flasks (76 pounds net)	23,064	16,443	−28.7
Molybdenum ore, MoS_2 content	1,195	781	−34.6
Silver troy ounces	65,460,073	61,097,727	−6.7
Tin	322	177	−45.0
Tungsten ore, 60 percent WO_3 equivalent	336	134	−60.1
Zinc (content of ore mined)	218,965	209,940	−4.1
NONMETALLIC MINERALS			
Graphite	12,977	23,634	+82.1
Strontium minerals (U. S. imports)	2,308	2,736	+18.5
Sulfur, crude	30,512	42,691	+39.9
HYDROCARBONS			
Coal	904,198	914,614	+1.2
Petroleum, crude barrels	38,203,105	43,547,360	+14.0

[1] Other minerals and products known to be produced but in quantities that have not been reported include cement, chalk, clay, fluorite, gypsum, lime, limestone, building and ornamental stone, salt, sodium carbonate, talc, and petroleum refinery products.

[5] Perez Durate, Constantino, Mexican Mining Must Have Tax Relief: Eng. and Min. Jour., vol. 146, No. 12, December 1945, pp. 96–99. Just, Evan, Mexico Is Strangling Its Mining Industry: Eng. and Min. Jour., vol. 147, No. 6, June 1946, pp. 76–80.

METALS

Cadmium.—On a mine basis, Mexico is probably the world's largest producer of cadmium, most of which is shipped to the United States contained in zinc concentrates and not added to the reported production of cadmium content of flue dust collected in Mexican zinc smelting. The indicated 54.3 percent rise in output of cadmium in the latter form, from 1944 to 1945, does not appear to be compatible with the 0.5 percent decrease in the production of slab zinc.

Copper.—The marked increase in copper production was made possible by successful operation of the new low-grade project of the Cananea Consolidated Copper Co. at Cananea, Sonora. Cananea is the most important producer in Mexico, and its new project, financed during the war by the Metals Reserve Company, has more than offset retarded operations in other units of the industry in 1945. The French enterprise Compagnie du Boleo sustained its Santa Rosalia mine during the past 2 years on subsidies granted by the Metals Reserve Company and the Mexican Government, and early in 1946 turned over its operation to a cooperative organization of the miners, retaining operative control of its smelter. Total 1945 production included 53,287 tons of furnace products and 8,393 tons contained in untreated ores and concentrates.

Copper exports amounted to 59,910 metric tons in 1945 (41,295 tons in 1944).

Iron and steel.—Cía. Fundidora de Fierro y Acero de Monterrey, S. A., operated the only two blast furnaces in Mexico producing pig iron and ferro-alloys until July 1944, when Altos Hornos de Mexico, S. A., started a third furnace of 350-ton capacity at Monclova, Coahuila. Consequently pig-iron output rose 54.6 percent in 1945 compared with 1944—an increase that has not been reconciled with the reported 6.3-percent decrease in the production of iron ore. Steel production likewise rose from roughly 198,000 tons in 1944 to 235,000 tons in 1945, an increase of 18.7 percent to the highest output on record.

Lead.—Sustained demand and decreasing supplies of lead in the United States stimulated Mexican production to a 10.8-percent increase in 1945 over 1944. The total comprised 201,078 metric tons of lead in refined and impure bars and oxides, plus 4,237 tons contained in untreated concentrates. Activity in the lead industry is expected to continue at a high level throughout 1946.

Precious metals.—On September 21, 1945, the United States increased the purchase price of foreign silver from 44.750 to 71.111 cents per troy ounce; but increased taxes and labor costs shortly thereafter canceled the benefits to the Mexican industry, and production continued the decline that started in 1943. Gold, largely a byproduct of silver and base-metal mining, also declined, though to a lesser extent.

Other metals.—Production of antimony, arsenic, bismuth, manganese, mercury, molybdenum, tin, tungsten, and zinc decreased in line with general conditions as indicated in the introductory paragraph. Official figures on tin are believed to be incomplete throughout the

717372—47——102

years, as illegal local sales have long been common practice. Actual production has been estimated at roughly 1,000 tons annually during the late war years.

NONMETALLIC MINERALS

Fluorspar.—While exports of fluorspar decreased from 56,450 metric tons in 1944 to 50,251 tons in 1945, the figures are not necessarily indicative of the trend in production, as the fluorite needs of the Mexican steel industry are also supplied, for the most part, by mines in the State of Guerrero.

Graphite.—United States requirements for Mexican amorphous graphite were well-sustained in 1945, with a resulting 82-percent gain in production, largely from southern Sonora.

Mica.—Mica mining by Cía. Mercantil de Oaxaca, the only producer in Mexico, was discontinued in June 1945 following production that had dwindled to only 15 to 20 tons during the 6-month period. Exports amounting to 409 tons in 1945 compared with 111 tons in 1944 are thought to have been made up largely of Canadian mica imported under bond for reexport after splitting and trimming in the shops of the Oaxaca Co.

Strontium.—United States imports of strontium minerals indicate that Mexican production was well-maintained throughout the year at a level higher than in 1944 but well below that in 1942–43.

Sulfur.—Sulfur requirements of the Mexican chemical industry are partly supplied by imports totaling 4,000 to 6,000 tons annually. Sulfur ore found in 18 States and produced chiefly in the area of Cerritos, San Louis Potosi, is of very poor grade, containing only 15 to 20 percent pure sulfur, and is in part exported; countries of destination for the past 4 years were the United States, Nicaragua, Guatemala, and Argentina. Official production figures are incomplete insofar as they fail to include small amounts of sulfur extracted for local use. Two new companies, one a Government entity, are considering development of deposits in the Tehuantepec area.

Other nonmetallic minerals.—In 1939, 5 companies operated 7 cement plants in Mexico; 10 firms employing 1,425 people are said to have entered the field since April 1941. Production amounted to 588,476 metric tons in 1942 and 578,253 tons in 1943 but has not been reported since. No reports have been received covering production of chalk, clay, gypsum, lime and limestone, construction and ornamental stone, salt, sodium carbonate, or talc.

HYDROCARBONS

Coal.—Production of coal, chiefly from the Sabinas field in the State of Coahuila, exceeded that of 1944 but continued far short of the peak of 1,444,498 metric tons attained in 1925. Ordinarily output is adequate for domestic requirements.

Petroleum.—Although a substantial increase in crude petroleum production made 1945 Mexico's best year since 1940, it was insufficient to mark a definite change of the general even trend that has fluctuated between 35 and 47 million barrels annually since the end of 1928. (Mexico's peak year was 1921, with 193.4 million barrels.)

Of the 1945 total, 88 percent came from the Tampico area and 12 percent from the Isthmus of Tehuantepec. The Poza Rica field alone supplied 19,148,452 barrels, or 44 percent of the total. Wells in northeastern Mexico (States of Tamaulipas and Coahuila) yield natural gas and some distillate in unreported quantities. Petróleos Mexicanos employed 28 exploration parties in 1945 (17 geological, 6 seismic, 4 gravity, and 1 electrical) and plans to increase the total to 36 in 1946, supplemented with 30 exploratory and 45 development wells per year. Known reserves have been calculated at 870 million barrels, of which more than 500 million belong to the Poza Rica field.

The Government (Petróleos Mexicanos) operates 11 refining plants having a total throughput capacity of 149,000 barrels daily. By 1947, 28,000-barrel capacity is expected to be added to the Atzcapotzalco plant near Mexico City and a new 30,000-barrel plant completed at Salamanca, State of Guanajuato. The Salamanca plant is being built partly from old equipment from the Mata Redonda and Bella Vista plants, which are being dismantled, deducting 16,000 barrels from the present national capacity and leaving a total expected capacity of 191,000 barrels per day by 1947. Actual production of petroleum refinery products has not been reported.

BRITISH HONDURAS

The only known mineral industry in British Honduras is the operation of Government-owned limestone quarries. Limestone production during the past 5 years has been approximately as follows, in metric tons: 1941–40,600; 1942–36,700; 1943–34,300; 1944–43,800; 1945–29,000.

COSTA RICA

The United States (exclusive buyer) imported 3,054 troy ounces of gold and 1,380 troy ounces of silver contained in concentrates and base bullion from Costa Rica in 1945, compared with 3,606 ounces of gold and 3,506 ounces of silver in like form in 1944. These figures, though possibly including small quantities of precious metal scrap, are believed to be closely indicative of Costa Rican total production and exports, which in 1945 reached the lowest point in many years. In the early part of 1945 Panammas, Inc. (controlled by Ventures, Ltd., of Toronto and New York), began exploring the Albangares mining properties under an option granted the previous year and extending to July 1946. Later in 1945 the New York and Honduras Rosario Mining Co. began a similar operation at Aguacate where, at the Union de Aguacate mine, a small cyanide plant was erected. Other groups have plans for both dredging and digging in the sands and gravels of the Osa Peninsula near the Panama border. The future of precious metal mining will be determined largely by the success or failure of these various ventures.

Several million tons of magnetic iron ore, in a deposit at "Old Harbor" on the Atlantic coast south of Limon, has been reported by American engineers. No action has been taken toward development of these deposits, nor toward reopening manganese deposits on the Nicoya Peninsula.[6]

[6] See Roberts, R. J., Manganese Deposits in Costa Rica: Geol. Survey Bull. 935-H, 1944 pp. 387-414.

An estimated 2,500 metric tons of lime and 50 tons of kieselguhr were produced during 1945 for domestic use. Evaporation of sea water on the Pacific coast yielded 6,033 metric tons of salt.

An American firm sent representatives to Costa Rica to investigate the possibilities of conducting an intensive survey of potential oil fields.

GUATEMALA

METALS

Chromite.—Production of chromite in the Department of Jalapa amounted to 442 metric tons containing 211 tons of Cr_2O_3 in 1945, compared with 97 tons containing 43 tons of Cr_2O_3 in 1944. As usual, all shipments went to the United States.

Gold.—Panning of alluvial gravels by individuals has virtually ceased, judging by United States imports of gold from Guatemala, which dropped from 126 troy ounces in 1944 to 66 ounces in 1945. The only dredging operation in the country was abandoned several years ago. Production in 1941 was 2,560 ounces.

Iron.—About 150 tons of iron ore a month are mined from a deposit near Zacapa for use in the Guatemala City cement plant. Late in 1945 an American mining company is reported to have started negotiations with the Guatemalan Government for an iron-mining concession.

Lead.—Lead ore is mined at a small, fairly uniform rate from workings in the vicinity of Huehuetenango. Recovery of metal in small local furnaces, for domestic use only, amounted to 115 metric tons in 1945 and 136 tons in 1944.

NONMETALLIC MINERALS

Cement.—La Fabrica National de Cemento de los Señores Novella y Cía. continued to operate the country's only cement plant near Guatemala City throughout 1945, but production figures have not been reported. The product of the plant is consumed totally within Guatemala.

Mica.—The sporadic mining of mica in the Departments of Quiché and Baja Verapaz was revived in 1941 by wartime demand in the United States, but the peak output (exports) attained in 1943 amounted to only 5,356 kilograms, dropping to 468 kilograms in 1944. Production in 1945, as gaged by United States imports, was 1,156 kilograms (2,549 pounds) valued at $1,146.

Quartz crystal.—The United States imported a total of 1,091 kilograms of quartz crystal from Guatemala during the 3-year period 1942–44 and none in 1945; experimental production apparently has proved unprofitable and has ceased.

Other nonmetallic minerals.—Production of salt, amounting to 12,618 metric tons in 1943 and 12,645 tons in 1944, was unreported in 1945. Also unreported was the usually small production of mineral pigments and sulfur.

Petroleum.—Inasmuch as Guatemalan law limits petroleum exploration to companies in which at least 51 percent of the stock is owned by citizens of Guatemala, no concessions have been explored, and none are now held despite the presence of oil seeps and the recognition of other factors favorable to production possibilities in the northeastern part of the country. Proposed revision of the petroleum law, designed to be more attractive to outside capital, is expected to be offered to the Congress of Guatemala before the end of 1946.

HONDURAS

The general economy of Honduras was at a high level throughout 1945. Although mineral production showed no improvement over the preceding year, mineral interest has been active in exploration and development that may well lead to increased production during the years to come. All major active mining operations and most of the claims and exploration work in Honduras are under the ownership, control, and management of United States interests.

Precious metals.—The New York and Honduras Rosario Mining Co. continued to be the only major producer of precious metals in the country, supplying from its San Juancito mine, Department of Francisco Morazan,[7] all of the 3,042,604 ounces of silver and most of the 20,060 ounces of gold exported to the United States during the year. Rosario's shipments were in the form of doré bullion. Placer gold, amounting to less than a thousand ounces, was bought from individuals by a Tegucigalpa firm and exported as bullion. In February the Rosario company obtained controlling interest in the silver-gold mines of Yuscaran in the Department of El Paraiso. Thorough exploratory examination has been started at this property and at the previously acquired El Mochito silver-lead and Caliche silver mines on the west side of Lake Yojoa, Department of Santa Barbara, and El Transito gold property (held jointly with the American Smelting & Refining Co.) near the Bay of Fonseca, Department of El Valle.

Compañía Minera Agua Fría, S. A., which has been inactive since May 1943, started exploratory work during the third quarter of 1945 preparatory to resuming production at its gold-silver mine near Danli, Department of Francisco Morazan. At the close of the year the entire 1942–43 output of this mine, containing 299,682 ounces of gold, 234 ounces of silver, and relatively insignificant amounts of arsenic, copper, antimony, and lead, was still in storage awaiting shipment to the United States.

New York interests have taken over the San Andres gold-silver property southwest of Santa Rosa de Copan and hope to start operating in 1946. Pan American Mining & Development Co. of Salt Lake City, Utah, acquired a 2,000-hectare concession in the Department of Olancho and started construction of an airfield and 60-mile road in preparation for the development of gold placers from its headquarters camp at Viajao. Other private American interests obtained control of gold-placer claims covering 2,000 hectares in the Territory of Mosquitia and planned to test the ground during the closing months of the year.

Antimony.—The production of antimony in Honduras ceased in 1945, because of unfavorable contract conditions, with the shipment of 28 metric tons of 61-percent hand-sorted ore from El Quetzal mine, Department of Copan, in February.

[7] Formerly Department of Tegucigalpa.

Mercury.—Development of a cinnabar deposit at Los Izotes, Department of Francisco Morazan, was started in 1941 and culminated during the second quarter of 1945 in the production of 23 flasks of mercury that were purchased and exported by Casa Uhler of Tegucigalpa. Operations have been discontinued and are not expected to be resumed.

Iron and manganese.—An American mining company applied in December 1945 for the right to examine and possibly develop iron (and manganese) deposits in (1) a 2,000-hectare concession at Agalteca, Department of Francisco Morazan; (2) a 1,000-hectare concession in the Department of Yoro and Atlántida; and (3) a 1,000-hectare concession in the Department of Comayagua. The Agalteca deposit is a hematite-magnetite iron ore, believed to be high-grade but of limited tonnage.

Salt.—Production of salt by the evaporation of sea water was estimated at 900 metric tons in 1945—the lowest in the past 5 years. Total output is consumed within the country.

Petroleum.—The Government has granted several concessions for petroleum exploration, and other applications are pending; most of these are in the Department of Olancho and the Territory of Mosquitia. The presence of petroleum in commercial quantity has yet to be proved.

NICARAGUA

Gold and silver.—The production of precious metals, as measured by exports, all of which are destined to the United States, amounted to 207,427 troy ounces of gold and 234,379 troy ounces of silver in 1945, showing a slight decline from the 223,910 ounces of gold and 248,529 ounces of silver shipped in 1944. This trend was of some concern to producers, whose hopes of increased postwar production had made inadequate allowance for the time element between the eased supply situation and arrival of new equipment at the mines. Corrective action was under way by February 1946, however, as owners undertook to operate the mines at full capacity 24 hours a day.

As usual in recent years, five major and four minor companies supplied the total gold-silver production of the country. The companies, in the order of value of output, were La Luz Mines, Ltd., Neptune Gold Mining Co., Empresa Minera de Nicaragua, Cía. Minera de La India, Cía. Minera de Jabalí, Cía. Minas Matagalpa, Esmeralda, San Juan Mines Co., and Cía. Minera San Gregorio.

Other metals.—The largest positive reserve of copper ore in Central America has been blocked out at the Rosita mine in the Department of Bluefield, but is not being exploited. Negligible quantities of copper, lead, and zinc are shipped with the gold-silver concentrates.

Salt.—Recovery of salt for domestic use by the evaporation of sea water continued on the west coast at the yearly rate of about 6,000 metric tons. A few hundred tons of salt are imported every year to supplement this supply.

Cement.—Production of cement by Nicaragua's single cement plant at San Rafael del Sur is estimated at 16,000 metric tons in 1945, based on actual production of 3,962 tons in the first 3 months. Production was 10,034 tons in 1944, 10,627 tons in 1943, and 620 tons in 1942, the first year of operation.

Petroleum.—The American International Petroleum & Refining Co., controlled jointly by the Gulf Oil Co. and the Atlantic Refining Co., engaged in a geologic and seismographic search for possible oil structures during 1945 and drilled one deep hole that yielded nothing beyond stratigraphic information.

PANAMA

Until the end of 1942, Panama produced salt and diminishing quantities of gold. The year 1943 saw no mineral production of any kind; 10,000 metric tons of salt were recovered by the evaporation of sea water in 1944 and 2,437 metric tons in 1945, while gold mining remained dormant. Salt production is controlled by the Banco Agro-Pecuario e Industrial, and that of the past 2 years represents the maximum output permitted.

EL SALVADOR

Precious metals.—Metal mining, as measured by United States imports from El Salvador, the only datum now available, was confined to the output of 9,823 troy ounces of gold and 212,864 troy ounces of silver in 1945, compared with 23,204 ounces of gold and 305,922 ounces of silver in 1944.

Nonmetallic minerals.—There is no record of the quarrying of ornamental stone since 1941, when 1,509 metric tons were shipped to the United States. Salt is regularly recovered from sea water in unreported quantity, and about 400 tons are shipped annually to neighboring countries.

SOUTH AMERICA [8]

BY SUMNER M. ANDERSON

ARGENTINA

Under a prolonged policy of military secrecy, Argentina has withheld production figures for the last 2 to 3 years on such mineral items as antimony, chromite, copper, iron and steel, asbestos, barite, construction materials and ornamental stone, clay, diatomite, feldspar, fluorspar, garnet, mineral water, mineral pigments, salt, sulfur, sulfates, talc, volcanic materials, zeolites, asphalites, and coal, while reports on gold, silver, lead, zinc, and tin have been incomplete. Of the materials in this list, however, only gold and silver, lead and zinc, construction materials (including cement, lime, stone, and sand), and salt are produced in important quantities.

Break-down of rail transportation and termination of United States purchasing agreements seriously depressed the mining industry in 1945. Refined-lead production of 21,159 metric tons, of which 6,019 tons were derived from imported Bolivian concentrates, was the lowest in 3 years. Zinc content of zinc concentrates, estimated at 14,300 tons, was approximately 30 percent less than the 1944 output

[8] Unless otherwise indicated, all statistics for South American countries are in metric tons.

and the lowest in at least 7 years. Electrolytic zinc probably changed little from the estimated 1,500 tons in 1944. Amounts of gold and silver mined are unreported; silver refined amounted to 909,352 troy ounces in 1945 compared with 1,723,280 ounces in 1943, consistent with the drop in output of lead and zinc concentrates from which most of the silver is derived. An estimated 550 tons of tin mined in 1945 were approximately 225 tons less than in the previous year and represented only half the 1941 output. Approximate production of tungsten concentrates (60 percent WO_3 equivalent) in 1945, the lowest since 1934, was only 500 metric tons compared with 2,488 tons in the peak year 1944 and 2,420 tons in 1943. Output of beryllium ore (11 percent BeO), which reached 2,186 metric tons in 1941, declined rapidly to about 300 tons in 1944 and only 40 tons in 1945, during which year exportation was prohibited by the Argentine Government. Slightly more than 2 metric tons of tantalite containing approximately 44 percent Ta_2O_5 were mined in 1945 (8 tons in 1944). Output of sheet mica amounted to about 170 metric tons in 1945 compared to 187 tons in 1944 and 525 tons in the peak year 1942.

Following the lead of other Latin American countries, Argentina issued a decree on September 26, 1945, prohibiting the export of uranium minerals, production of which has never been reported.

The outstanding event of the year to the mining industry was Decree 31,559, Department of Industry and Commerce, December 12, 1945, authorizing Yacimientos Petróliferos Fiscales (State Oil Fields) to explore and exploit chromite, tungsten, molybdenum, nickel, cobalt, vanadium, bauxite, kaolin, bentonite, clay, fluorite, barite, "and all other deposits which are to be found within the holdings of YPF." This decree is another long step toward nationalization of the mineral industries and away from the mining code sanctioned by Congress December 8, 1886, which specifically opposed operation of mines by the State.

Reserves of 6,300,000 tons of good-quality coal at the Rio Turbio mine and 2,000,000 tons at Cancha Carrera, Santa Cruz, have been mapped by the Yacimientos Petróliferos Fiscales, adding somewhat to a totally inadequate national supply. Control of both coal and natural-gas exploitation, however, has recently been transferred from YPF to the Dirección National de la Energía. How the control of natural gas will function independently from that of petroleum remains to be seen.

Argentina is second only to Venezuela in South American production of petroleum but requires imports of crude in quantities greater than have been obtainable during the war emergency to meet domestic needs. In 1945 approximately 1,800,000 tons of foodstuffs (mostly grain) were burned to relieve the fuel shortage. Production of crude petroleum attained its peak in 1943, with 27,714,000 barrels. Production in 1945 (with 1944 equivalents in parentheses) amounted to 22,880,910 (24,230,198) barrels, of which 15,439,169 (16,205,925) barrels came from YPF and 7,421,741 (8,024,273) barrels from five private companies. The four producing districts, in order of importance, were Comodoro Rivadavia, Mendoza, Plaza Huincul, and Salta. The refineries of the country processed 23,131,632 (23,634,386) barrels of crude produced domestically and 980,598 (976,686) barrels of imported crude, making a total of 24,112,230 (24,611,072) barrels.

From this intake, 23,107,684 (23,723,182) barrels of refinery products were derived, including, in order of volume, fuel oil, gasoline, Diesel oil, kerosine, agricol (tractor oil), coke, lubricants, asphalt, gas oil, supergas, aviation gasoline, grease, paraffin, and denaturalizers.

Argentina has no pipe lines, aside from field gathering systems. Transportation is handled primarily by river and ocean tankers, of which YPF has an 80,000-ton fleet, and railway tank cars.

In addition to crude petroleum, Argentina produces about 110,000 barrels of natural gasoline and 675 million cubic meters of natural gas annually, but exact output in 1945 has not yet been reported. Wet gas is drawn from all four of the petroleum districts, dry gas from the Comodoro Rivadavia and Plaza Huincul districts only.

BOLIVIA

Minerals comprise well over 90 percent of the total value of Bolivian exports, and exports of metallic minerals (except bismuth and gold), asbestos, fluorspar, mica, and sulfur are regarded as closely indicative of production. On this basis, the total value of mineral production in 1945 was practically the same as in 1944, but some change was seen in proportional distribution. Tin, which supplied 73 percent of the total value in 1944, amounted to 82 percent in 1945; tungsten dropped from 14 to 4.5 percent; silver rose relatively to slightly more than tungsten in value. Quantitative changes are presented in the following table.

Summary of mineral production of Bolivia, 1944–45

[Metric tons, except as otherwise indicated]

Mineral	1944	1945	Difference (percent)
METALS IN CONCENTRATES (EXPORTS)			
Antimony	7,448	5,535	−25.7
Copper	6,170	6,097	−1.2
Lead	9,047	9,508	+5.1
Mercury ... flasks	2	3	+50.0
Silver ... troy ounces	6,797,631	6,683,561	−1.7
Tin	39,341	43,168	+9.7
Tungsten ore, 60 percent WO_3 equivalent	7,935	3,851	−51.5
Zinc	16,319	20,976	+28.5
NONMETALLIC MINERALS (EXPORTS)			
Asbestos	13	61	
Fluorspar		19	
Mica ... kilograms	1,928		−100.0
Sulfur	6,146	617	−89.7
HYDROCARBONS (PRODUCTION)			
Petroleum, crude ... barrels	314,467	[1] 406,114	[1] +29.1

[1] Estimated.

METALS

Antimony.—Bolivia's lowest level of antimony production since 1937 was reached in the second half of 1944 following termination of the purchase contract with the United States Commercial Company at the close of the preceding year and the accumulation of stocks in the United States. In 1945 the demand improved; and output in Bolivia, stimulated also by reduced taxation, climbed fairly steadily throughout the year but at a rate insufficient to raise the total to that of 1944. Only one operating mine in the country is mechanized;

the industry is conducted principally in small and medium mines, without benefit of mechanical equipment. Improvement in 1946 is anticipated because of the price guarantee offered by Banco Minero until December 31, 1946.

Bismuth.—Exports of bismuth in concentrates ordinarily reflect production but are not believed to have done so in the past 2 years. When the purchase agreement with the United States Commercial Company was terminated at the close of 1943, shipments virtually ceased, although concentrates separated as a byproduct of tin mining continued to accumulate within the country. On May 1, 1946, the Banco Minero raised the price on bismuth concentrates, and stocks and current mill output again found a market. Exports of contained metal amounted to 12,419 kilograms in 1943, 605 in 1944, and 15,337 in 1945; the 1945 quantity undoubtedy represented concentrates treated during both 1944 and 1945.

Copper.—The American Smelting and Refining Co. (Cía. American Smelting Bolivina Consolidada) at Corocoro and Mauricio Hochschild, S. A. M. I. (Cía. Minera Huanchaca de Bolivia) have maintained copper production at an even though relatively unimportant rate for the past 6 years. Tonnage output was retarded slightly in 1945 by the shortage of labor.

Gold and silver.—For the past several years recorded exports of gold have been less than production, though to an extent that probably will never be known. The byproduct of other mining is regularly exported in the ores and concentrates of base metals, but a large part of that recovered from placers has escaped the country by smuggling to Argentina and Peru because of (1) the willingness of individuals in those countries to pay more than the world price and (2) the offerings of Banco Central and Banco Minero to purchase at less than world price. By March 1945 purchases of the Banco Minero had dropped to nothing, and the Government attacked the "flight-of-gold" problem by authorizing the two banks to purchase gold at world prices in foreign exchange, which may be utilized to import luxury goods, effective May 23. Purchases during the remainder of the year increased greatly. Negotiation for a new contract for exploitation of the Tipuasi-Rio Kaka were started, to replace the old contract abrogated in 1944. If successfully concluded, this should increase production further in 1946. Official exports amounted to 4,561 troy ounces in 1944 and 28,901 ounces in 1945.

Bolivia is surpassed only by Mexico and Peru in Latin American production of silver. Exports, which showed a negligible decrease in 1945, consist of silver contained in the ores and concentrates of base metals—principally tin.

Lead.—Production of lead, which threatened to decline further in 1945, was maintained and slightly improved by an advanced price schedule established May 1 by the Banco Minero and a reduction in freight rates obtained in April on the Villazón-Atocha Railway in southern Bolivia. Cía. Huanchaca de Bolivia continued to be the country's leading producer; and, as usual, about 60 percent of the total output went to Argentina for smelting. The Government is discussing construction of a lead smelter in southern Bolivia to further stimulate the industry, and the outlook for 1946 is good.

Tin.—Production of tin in 1945 fluctuated with price, with the bulk of the year's over-all increase showing between March 3 and October 1, when the contract agreement between the United States Commercial Company and independent producers called for payment of U. S. $0.63½ per pound of contained tin. Price was $0.60 under the old contract and $0.62 during the last quarter of 1945. Individual mines that showed the greatest increase were the Colquiri and San José-Machacamarca mines of Cía. Minera de Oruro and the Chorolque mine of Cía. Aramayo de Mines en Bolivia, all exploiting rich viens discovered in late 1944 and early 1945; the Santa Fé mine of Empresa Minera de Santa Fé; the Chojlla Tanapaca mine of International Mining Corp. (W. R. Grace); and the Huanuni mine of the Bolivian Tin & Tungsten Corp., which suspended operation in the last quarter to install a new flotation plant. Other operations that were suspended during the year—all small—include Patino's Colquechaca mine on January 15, and the Japo mine of Bolivian Tin & Tungsten Corp. and the Vino mine of Cía. Minera de Oruro on April 1. The Bolivian International Mining Corp., which suspended in 1944, reopened dredging operations June 18. To permit continuation of operation by small miners, the Government on May 21 suspended collection of the principal export tax on tin, but in June the Banco Minero stopped purchase from the Department of Potosi of ore containing less than 18 percent tin and raised the limit to 20 percent on the first of August. This limitation had little effect other than on the small producers, but it raised the average grade of ore sold to the United States Commercial Company from 37.28 percent in the second quarter to 39.03 percent in the third quarter of the year. United States purchases are smelted at Texas City; output of mines belonging to the Patino interests continued to be sold by contract to England.

The new sink-and-float plant at Patino's Llallagua mine at Catavi showed promise of successful operation in 1946, but the Tainton-process plant of Cía. Minera Unificada del Cerro de Potosi (Mauricio Hochschild) continues to be a failure.

Contract prices with Bolivian independent producers call for payment of $0.60½ per pound for tin delivered in the first quarter of 1946 and $0.58½ per pound in the second quarter. Production outlook for the year is uncertain and will be strongly influenced by prices prevailing during the second half of the period.

Tungsten.—Although tungsten-ore production attained its wartime peak in 1944, a downward trend followed price reductions in July and November, and the year closed with termination of the purchase contract with the United States Commercial Company. On January 30, 1945, one of the major producers—the Bolsa Negra mine of Mauricio Hochschild—was forced to follow the example of many smaller producers by suspending operations. Improvement of demand and price during the second and third quarters collapsed in the fourth, and the industry failed to respond to a major reduction in export taxes; 1945 closed with a total output of tungsten ore less than half that of the preceding year and the expectation of further decline in 1946.

Zinc.—Zinc mining recovered from its 1944 decline to within 98 tons of peak production in 1943. The turn came in the second quarter, with the opening of important markets in Great Britain, Belgium, France, and Spain, supplementing that in the United States. Ore from the Cía. Huanchaca de Bolivia, the country's most important zinc producer, contains silver, and production received additional upward impetus following the United States price increase for foreign silver on September 21. Output of zinc in 1946 is expected to exceed that of 1945.

NONMETALLIC MINERALS

Asbestos.—Asbestos mining, never important in Bolivia, has supplied exports decreasing from 211 tons in 1941 to 22 tons in 1943 and 13 in 1944. Mining was resumed east of Cochabamba in 1945, and 61 tons were shipped; the fiber is unsatisfactory for spinning but good for cement shingles. Requirements of the Argentine market appear to justify a prediction of increased production in 1946.

Fluorspar.—Investigations of deposits, made during the early part of 1945, led to Bolivia's first production and export of fluorspar, amounting to 19 tons. Continued exploitation of the mineral will be determined by price.

Other nonmetallic minerals.—Exploitation of a mica-columbite deposit near Santa Cruz failed to materialize, and mica exports dropped to nothing. Shipments of sulfur to neighboring countries dwindled from a few thousand to a few hundred tons. Production of cement, stone, clay, and salt for domestic use has not been reported.

HYDROCARBONS

Petroleum.—Development of Bolivia's oil industry was curtailed during the war by scarcity of materials. Though relatively unimportant quantitatively, production in 1945 showed a substantial percentage increase over 1944, and an aggressive drilling campaign is planned as soon as machinery and equipment become available in adequate amount. Of the estimated 406,114 barrels of crude petroleum produced in 1945, about 174,485 barrels came from the Bermejo field, 129,448 barrels from the Camiri field, and 102,181 barrels from the Sanandita field. A refining plant of 400 barrels daily capacity is operated at Sanandita and an 800-barrel plant at Camiri.

Since 1937 the Bolivian oil industry has been operated as a State monopoly through Yaciementos Petrólifera Fiscales Bolivina. Plans for expansion include working agreements with the Governments of Argentina and Brazil for joint exploration and development, wholly within Bolivia.

BRAZIL

At the time of review, 1945 figures on production had not been received from Brazil, and export statistics were incomplete. The overall minerals outlook at the end of the year was somewhat confused as a consequence of the deflationary trend resulting from termination in mid-1944 of several of the United States Government buying programs which had stimulated the Brazilian industry during most of the war period, although activity of the United States Commercial Company continued well into 1945 in some lines—notably mica and quartz crystal.

METALS

Aluminum.—The first aluminum metal to be made south of the Rio Grande was poured on March 29, 1945, at the new plant of Electro-Quimica do Brazil at Saramenha, near Ouro Preto, Minas Gerais. The plant is expected to attain an annual capacity of 2,500 metric tons of ingots, though by midyear only half the electric pots had been installed and the amount of current available was sufficient to permit production of only about 1,500 tons annually. Bauxite for the plant is obtained from the Ouro Preto deposit. Total Brazilian production of bauxite in 1945 is not known; exports (to Argentina) were 7,061 metric tons, compared with 2,979 tons in 1944.

Beryl, tantalite, and columbite.—These ores are ordinarily mined together from deposits that were not worked in 1945. The Departmento Nacional da Produção Mineral will not authorize export of beryl and tantalite at prices less than specified by Decree 224 of May 15, 1944, and reaffirmed by Decree 377 of June 1, 1945, which are about 80 percent higher than those last paid by the United States Commercial Company. Despite these decrees, 510 metric tons of beryl and 30 tons of tantalite were exported to the United States in 1945 from stocks, compared with 1,185 tons of beryl and 201 tons of tantalite in 1944. Columbite has not been shipped since 1942. Stocks at the end of 1945 amounted to 15 tons of tantalite and an estimated 500–750 tons of beryl; stocks of columbite are not known.

Chromite.—Chromite production, as measured by exports, which reached a peak of 7,813 metric tons in 1943, dropped to 4,721 tons in 1944 and 1,490 tons in 1945. Most if not all of the 1945 shipments were made by Chromium Mineração, S. A., from its property near Píuhy, Minas Gerais. Port stocks at the end of the year may have been sizable, as Chromita do Brazil, S. A., reported during the third quarter that it had been producing and shipping about 300 tons of chromite per month to São Paulo.

Gold.—Hoarding and smuggling of gold to an estimated extent of about a million grams (32,000 ounces) a year were practiced in 1943 and 1944, and on June 19, 1945, the Finance Ministry announced that producers would no longer be required to sell their gold to the Banco do Brazil, though the bank continues controls over gold exports and imports. Bank purchases from both underground and alluvial mines were much less in June and subsequent months than previously, but production is not believed to have declined substantially from the estimated 178,300 ounces of 1944.

Iron and steel.—Brazilian exports of iron ore increased 46 percent from 205,797 metric tons in 1944 to 299,994 tons in 1945. The principal export market is in Great Britain. In addition, an estimated 475,000 tons of iron ore was produced to supply the 25 charcoal blast furnaces in Brazil.

Progress on construction of the new iron and steel plant of National Steel (Companhia Siderúrgica National) at Volta Redonda is indicated by the following table.

Volta Redonda steel project—percent completion, end of year

Unit	1944	1945
Sewers and drains	100	100
Coke ovens and coke byproducts plant	98	100
Blast furnace	97	100
Water-supply system	95	100
Gas storage tanks and distribution system	65	100
Shops	95	99
Grading	88	98
Steam electric generating plant	80	98
Open-hearth furnaces	58	93
Plant railway	59	75
Electric power distribution system	55	74
Rolling mills	20	40

On February 20, 1946, the coke ovens were lighted for initial warming up, and production of pig iron is expected before the end of the year.[9]

Lead.—Companhia Plumbum, S. A., recovered lead carbonate and sulfide ore from the Panelas, or Brejauvas, mine near Ribeira, São Paulo—the only lead mine known to be active in 1945. In September the company produced its first lead bullion in a plant completed near the start of the year and equipped to refine lead and recover precious metals. Production of 7 tons of lead a day is anticipated, but the plant is handicapped by lack of adequate fuel; initial operations utilized charcoal.

Manganese.—While exports of manganese ore jumped from 146,983 metric tons in 1944 to 244,649 tons in 1945, production is estimated to have dropped from 203,751 to roughly 196,000 tons in the same period.

Titanium.—Exports of titanium ores in 1945, with comparable figures for 1944 in parentheses, were as follows, in metric tons: ilmenite, 5,000 (3,250); rutile, 160 (1,564); total, 5,160 (4,814). All but 53 tons of rutile (20 tons in 1944) went to the United States.

Tungsten.—Exports of tungsten ore (60 percent WO_3 equivalent) increased from 2,221 metric tons in 1944 to 2,242 tons in 1945. Of the 1945 total, it is estimated that about 1,925 tons represents scheelite from northeastern Brazil and 114 tons wolframite from the Inhandjara mine in São Paulo. The grade of the shipped concentrates is believed to range from 65 to 70 percent WO_3.

Zirconium.—Zirconium ore (caldasite) exports dropped from 2,152 to 758 metric tons in the 1944–45 period. The ore was mined in São Paulo and southwestern Minas Gerais; all but 35 tons in 1944 and 49 tons in 1945 went to the United States.

NONMETALLIC MINERALS

Amblygonite.—This ore of lithium is a byproduct of beryl-tantalite mining in Brazil. Exports dropped from 600 metric tons in 1944 to nothing in 1945, when the beryl-tantalite mines were shut down.

[9] According to the Brazilian press, blowing-in of the 1,000-ton blastf urnace a Volta Redonda took place on June 9, 1946.

Barite.—Companhia Pigmentos Minerais Industrial e Comercial, S. A., proceeded with development of the ore body, installation of a mining and milling plant (completed January 22), and construction of an ore-loading dock on Camanũ Island, Bahia. A flotation mill was bought in Cuba for transfer to the property. All mining will be open-cut; enough development work has been done to assure 1,000,000 metric tons of barite, ranging from 88 to 98 percent $BaSO_4$. Production started early in the year, and the first shipment was made in April.

Cement.—The unusual building activity of the last 5 years has given tremendous impetus to cement consumption in Brazil. A reduction from the 1944 output of 809,908 metric tons is implied in the 15.7-percent reduction in electric power sales to the cement industry in 1945, although official sources have estimated an increase to approximately 815,000 tons. Imports have been reported as 101,755 metric tons in 1944 and 254,757 tons in 1945. Exports never greatly exceed 1,000 tons. Seven plants were in operation in 1945, and an extension of total capacity is planned for 1946.

Diamonds.—Diamond exports in 1945, compared parenthetically with 1944, were as follows, in carats: Gemstones, cut and rough, 91,910 (192,185); carbonados 3,910 (10,795); total 95,820 (202,980), of which 94 (97) percent went to the United States. A comparable decrease in production is believed to have taken place. Prices, high in the first quarter, were nearly equalized with those of the London syndicate in the second, when demand for rough stones by the local cutting industry exceeded supply, and stones—mainly small and melee—were imported from the United States and the Union of South Africa.

Mica.—Mica exports of 985 metric tons in 1945, compared with 941 tons in 1944, were the highest since 1940. With the tightening of grade specifications, many small operators were forced to shut down in the early part of the year with unsalable stocks on hand, and production declined until May, when the United States Commercial Company initiated a program of granting loans to exporters based on their purchases and stocks in the interior. Output improved greatly and was well-maintained until November 30, when all mica-purchasing agreements with the United States Commercial Company were terminated. The year closed with mica exporters establishing private marketing contacts.

Monazite.—Substantial recovery was seen in the export of 1,031 metric tons of monazite in 1945, compared with 3 tons in 1944 and 1,550 tons in 1943. Brazilian monazite is said to contain better than 6 percent thorium.

Quartz crystal.—Purchases of quartz crystal declined rapidly following the military collapse of Germany and were reflected in exports of only 609 metric tons for the total year 1945 (the lowest since 1938), compared with 1,122 tons in 1944. Based on statistics for the first 9 months of 1945, 77 percent of purchases were by private buyers in the United States, 15 percent by the United States Commercial Company (which terminated its purchase agreement on December 31), and 8 percent by Great Britain. The days of flush production in Brazil are past; several important deposits have been exhausted, and no new major discoveries have been made since 1941, and quality has declined steadily since 1943. Well-known areas that have been either abandoned or seriously reduced in productivity include the Pacú district among others in Minas Gerais, the Cristalina and Pium districts in Goiaz, and the Xique-Xique and Mimosa districts in Bahia.

Semiprecious stones.—End-of-the-war demand for jewelry was reflected in the spectacular increase in exports of semiprecious gemstones from 483,601 grams in 1944 to 1,895,041 grams in 1945. The more important stones usually included in this group are citrine, amethyst, aquamarine, garnet, topaz, gem agate, tourmaline, and turquoise.

HYDROCARBONS

Coal.—Efforts to improve the output of the southern Brazilian coal mines appear to have been successful relative to 1944 clean-coal production of 1,433,158 metric tons but to have fallen considerably short of expectations. Production in the first 6 months of 1945 was recorded at 1,043,994 tons as against 863,900 tons during the comparable period in 1944. Demand was and will continue to be strong, and opinion is to the effect that requirements of the Volta Redonda iron and steel plant, from the viewpoint of quality as well as quantity, will have to be heavily supplemented by imported coal for at least the next few years.

Petroleum.—Brazil's 7-year-old petroleum industry maintained production at 79,326 barrels in 1945, compared to an estimated 80,000 barrels in 1944. Distribution of 1945 production, in barrels, showed 36,663 from the Candeias field, 29,221 from the Itaparica field, 6,728 from the Lobato field, and 6,714 from the Aratu field. During the year 12 wells were completed, of which 2 were dry, 9 produced oil, and 1 struck gas. Production and utilization of natural gas have not been reported. The entire oil and gas industry is controlled by the Government-owned Conselho Nacional do Petroleo and is thus far confined to the State of Bahia.

BRITISH GUIANA

Bauxite.—Exports of bauxite from British Guiana continued to decline in 1945, amounting to 750,398 metric tons, compared with 891,103 tons in 1944 and 1,931,910 tons in the peak year 1943. (Actual production, in metric tons, over the same period was: 1945—678,482; 1944—928,178; 1943—1,919,060.) Most of the output was from the Demerara Bauxite Co., Ltd. (Aluminum Co. of Canada), but a small portion came from the Berbice Co., Ltd. (American Cyanamid & Chemical Corp.), which, inactive since 1943, resumed production late in 1945. The principal outlet for bauxite from British Guiana shifted in 1940 from the United States to Canada. In 1945 the United States took only 3,371 of the total tons exported. Decreased total exports are expected in 1946 and 1947.

Gold.—The trend of gold production that started down in 1939 turned upward in mid-1945 to bring the total year's output to 22,533 troy ounces, compared with 18,986 in 1944, 19,470 in 1943, and 29,267 in 1942. The increase is the result of discovery of new lode deposits and completion of a new cyanide plant by Cuyuni Goldfields, Ltd., and the discovery of new placer deposits by British Guiana Consolidated Goldfields, Ltd. In consequence of proposed further expansion by both companies—the only two gold-mining companies now operating in the Colony—and entrance into the industry of two new organizations—the Rupununi Gold Mining Co. and the Wairiri Gold Mines—production in the next several years is expected to exceed the 1938 output of 38,482 ounces. That portion of production furnished by individual prospectors probably will not change substantially.

Since 1940, increasing amounts of gold have been sold within the Colony, where a ready market has been afforded by the small jewelry-manufacturing industry, largely operated by East Indians. Exports, chiefly to the United States, amounted to 9,711 ounces in 1945; 7,571 in 1944; 11,611 in 1943; 18,572 in 1942.

Diamonds.—Depletion of readily available deposits, lack of proper internal transportation, high cost of food in the interior, lack of organization of the industry, and loss of miners to other industries are held responsible for the continued decline in the production of diamonds, which has dropped from more than 214,000 carats in the peak year 1923 to only 15,442 carats in 1945. Exports of diamonds, however, rose to 17,251 carats valued at $513,677 (the highest value since 1933) in 1945 from 13,911 carats valued at $327,310 in 1944. In order to encourage the Colony's small cutting and polishing industry, established in early 1944, the export duty on cut diamonds and cut and polished diamonds was abolished.

Granite.—Output of quarried granite amounted to 25,688 metric tons in 1945, slightly more than in the years 1941 and 1942. Production was only 7,833 tons in 1943 and none in 1944.

CHILE

Production figures for Chile in 1945 are totally incomplete and have been only partly estimated at the time of review, although trends are reasonably clear. Mining in general declined from the high level of 1944 but continued to be the mainstay of the Chilean economy, supplying 80 percent of the value of total exports; on the whole, the industry enjoyed one of the best years on record.

METALS

Copper.—Refining of copper was down some 7.6 percent from the previous year, subsiding from an estimated 500,573 metric tons in 1944 to 462,588 tons in 1945. The decrease was the normal result of the close of the war, but was not as abrupt as anticipated. The United States Commercial Company reduced its purchases from the large American producers (Chile Exploration, Andes Copper, and Braden Copper) and on September 30 canceled its contract with small producers, most of whom suspended operations shortly thereafter. The custom smelter at Naltagua ceased operations during the first quarter after more than 37 years of continuous service, and Chile's only other custom smelter at Chagres was shut down on November 19. The two smelters together produced 11,118 tons of copper in 1945, and their elimination makes it increasingly difficult

717372—47——103

for the few remaining Chilean operators of small mines to dispose of their ores and concentrates, which cannot be sold profitably to United States smelters because of high freight rates and production costs.

The reopening of European markets is not regarded as adequate to arrest a continued decline of production in 1946.

The industry suffered one of the most tragic disasters in mining history on June 19, when 354 persons were killed in an underground fire in El Tiente mine of the Braden Copper Co. Two persons subsequently died, and 100 recovered from injuries received.

Gold and silver.—Preliminary estimates indicate a 28-percent drop in the output of gold, from 243,883 troy ounces in 1944 to 180,462 ounces in 1945. The sharpest cut-back appears to have been in gold contained in ores, concentrates, and copper bars, which were directly tied in with United States Commercial Company contract. Silver, mostly a byproduct of other metal mining, is believed to have declined below the million mark in 1945. The estimate of output in 1944 was 1,094,894 troy ounces.

Iron.—With wartime curtailment of shipping, production of iron ore dropped from a roughly normal 1,600,000 tons annually to less than half a million in 1942 and 1943. Output was stepped up to 674,529 metric tons in 1944 and was further revived at the end of the war, bringing the total in 1945, when shipments to the United States were resumed, to 944,863 tons. Chilean pig-iron production, amounting to only about 6,000 tons annually, indicates the probability of large accumulated stocks of iron ore at El Tofo mines.

Manganese.—Although manganese mines in the Provinces of Coquimbo, Atacama, Antofagasta, and O'Higgins were shut down in mid-1944, interest is reviving. During the war, and prior to the shut-down, 234,000 tons of ore were stock-piled; and during the first 11 months of 1945, 86,064 tons were exported, mostly to the United States, compared with 4,038 tons in the equivalent period of 1944. Although it is true that a large part of the wartime production was made possible by premium prices, a number of the properties are capable of substantial output for normal markets if properly managed.

Mercury.—Mercury production by Chile's only mine at Punitaqui, Coquimbo, is believed to have stayed at roughly the 1,000-flask level to which it dropped in 1944. Small shipments were made to the United States and Argentina.

Molybdenum.—Separation of molybdenum concentrates from copper ores was pushed to about 1,800 tons in 1944 and held at virtually the same rate for 1945. About half the 1945 output was in port stocks at the end of the year; shipments were to the United States and Great Britain.

NONMETALLIC MINERALS

Nitrates and associated salts.—The production of natural nitrate, which declined steadily from 1,437,451 metric tons in 1940 to 973,615 tons in 1944, has been greatly stimulated in Chile since the end of the European phase of the war and a survey of Germany's reduced synthetic nitrate industry, resulting in recovery to an output of 1,366,877 tons in 1945. During the first half of the year ships for transport to consuming centers were obtained with great difficulty; but the situation eased considerably in the latter half, and accelerated activity was noted in the nitrate ports of Chile, particularly Tocopilla. Still of first importance to the Chilean industry is the disposal to be made of the war-born synthetic nitrate industry of the United States, and Chilean producers have endeavored to put every possible ton of production capacity into operation to recapture and hold a place on the future market. The two plants using the Guggenheim process—Maria Elena and Pedro de Valdivia—were producing at capacity for the first time in history. These two plants, together with the new Victoria plants of Cía. Tarapacá y Antofagasta, account for about two-thirds of Chile's nitrate production; plants employing the Shanks process, of which 19 were in operation at the end of the year, account for the other third. This third embraces the uneconomical part of the industry, employing hand methods at higher costs of operation. The number of nitrate "oficinas" in operation at the end of the year was 22, compared with 14 at the end of 1944.

Recovery of iodine and such minerals associated with nitrates as sodium, calcium, and magnesium sulfates, borax, potassium chloride, and sodium carbonate has not been reported for 1945, though sodium sulfate is known to have responded to an active market.

Other nonmetallic minerals.—No record of output of the various minor nonmetallic minerals is as yet available for 1945. Cement was in short supply throughout the year, and both of the country's two plants were shut down by strikes during part of the last quarter. Sulfur exports, all to Argentina, nearly doubled those of 1944; but production was down, and the plant of one company, Cía. Andes, was destroyed by fire October 4. Possibility of substantial increase in production is seen in the proposed development of a large and rich sulfur deposit in the high Cordillera east of Copiapó. Activity in the production of limestone, gypsum, clay, salt, phosphate rock, mineral pigments, kieselguhr, feldspar, quartz, and talc ranged from unspectacular to dormant, and in some lines cut-backs or shut-downs are anticipated with return to normal channels of international trade.

HYDROCARBONS

Coal.—Coal production dropped about 10 percent from that of 1944 to an estimated 1,836,000 metric tons (net weight) in 1945. Production and consumption were nearly in balance for the first half of the year, but at the end of the year a critical shortage was facing Chile, primarily as a result of labor difficulties in the principal coal-mining districts. The largest mine in Magallanes Province was closed early in the year, terminating shipments of coal from that district to Argentina. The immediate coal problem facing Chile is the development of new mines on its proved lands.

Petroleum.—The outstanding mineral development during 1945 was the discovery of oil at Springhill, 6 miles from the north end of the Straits of Magellan on the island of Tierra del Fuego, on December 29. The premium-quality paraffin-base oil has an estimated free flow of 200 barrels daily and represents the world's farthest-south production. The well was completed at 7,460 feet, and the producing Tertiary beds lie between 7,419 and 7,438 feet. A second test penetrated the same beds near midyear 1946, with negative results, but successful development of a field is anticipated.

From 1930–37, seven tests were drilled in the vicinity of the Straits, of which 1 produced 30 barrels of oil. The 1945 discovery resulted from seismic exploration by an American geophysical company that has been mapping the area since 1941 under the supervision and control of the semifiscal Fomento Corp., which plans further exploration and, if successful, installation of storage facilities and a pipe line to the nearest deep-water port, and construction of a refinery. The potential value of a native petroleum industry to Chile cannot be overestimated.

The discovery has revived speculation regarding the possibilities of petroleum development in Antarctica.

COLOMBIA

METALS

Precious metals.—Production of gold and silver declined appreciably in 1945, while that of platinum, stimulated by strategic need in the United States until the close of hostilities, registered a slight gain. Output in 1945, with comparable figures for 1944 in parentheses, was as follows, in troy ounces: gold, 506,695 (553,530); silver, 168,699 (197,323); and platinum, 34,758 (34,304). Total platinum exported, amounting to 35,129 ounces, went to the United States.

Iron and steel.—Starting in 1942, a small iron furnace at Capitanes has been producing about 1,500 metric tons of iron annually for sale to domestic foundries.

Progress of the steel plant of Empressa Siderúrgica, S.A., at Medellín, which started operating on a commercial scale in 1944, has not been reported for 1945. A new project sponsored by the Instituto de Fomento Industrial plans construction of a plant to utilize the iron-ore deposit at Paz del Rio for the annual production of more than 100,000 tons of such iron and steel products as rails, structural shapes, reinforcing rods, wire, and cast-iron pipe. Adequate capital for the project is believed to be obtainable from Latin America and Europe; United States capital has been unresponsive.

Lead.—Exploration for new lead deposits was terminated without success in March 1945. A small pilot plant at Mochancuta has produced 10 metric tons of metallic lead in 1942, 4 tons in 1943, nothing in 1944, and 20 tons in 1945.

NONMETALLIC MINERALS

Barite.—About 2,600 tons of barite have been mined in each of the past 2 years, mostly from open-cuts at Los Santos in Santander, but supplemented by several small mines in southern Tolima. Extensive reserves of barite, as yet unexploited, were discovered only a few years ago at Chiriguaná, Magdalena. The mineral is sold chiefly for use in oil-well drilling; very minor amounts are used in the local manufacture of paint and other commodities.

Clay.—Clay is undoubtedly produced in larger tonnage than any other industrial mineral in Colombia, but its exploitation is scattered among so many small manufacturers of tile, brick, and other ceramic products that production figures are not obtainable.

Cement.—Notwithstanding shortages of machinery replacements, spare parts, paper bags, and trucking equipment, the six plants of five companies pushed Colombia's cement production to a new record, continuing an upward trend that has been broken but once (1942) since 1935. Production in 1945 amounted to 300,981 metric tons, compared with 281,626 tons in 1944. Plans for the construction of two additional cement plants, announced in 1944, have not yet materialized.

Emeralds.—The Muzo emerald mines ceased operations in 1938—the Chivor mines about 1940—pending sale of a large stock of stones that had accumulated in the Bank of the Republic, which has a Government monopoly on the sale of uncut emeralds for export. The largest recent single transaction was the sale to a United States firm of stones valued at $685,000 during the first week of 1946.

Gypsum.—Estimates of gypsum production, used mostly for the manufacture of cement, indicate a rise from roughly 13,200 metric tons in 1944 to 17,200 tons in 1945.

Salt.—In 1944 Colombian total production of salt was unreported, but that recovered from the evaporation of sea water amounted to 31,671 metric tons. In 1945 only 14,445 tons were so derived, plus 90,627 tons in brines and rock salt, making a total salt output of 105,072 tons for the year.

Other industrial minerals.—In an attempt to contribute as much as possible to the strategic mineral need of the United Nations during 1942–44, efforts were made to find and exploit deposits of mica, optical calcite, and quartz crystal. These efforts resulted in negligible production, however, and were abandoned before 1945 as commercially unprofitable.

HYDROCARBONS

Coal.—Coal production, which rose steadily from 1941 to the end of 1944, had not yet been reported for 1945 but may be expected to have retained a position close to or exceeding the half-million-ton mark reached in the preceding year. Exports amounted to only 137 metric tons in 1944 and 177 tons during the first 7 months of 1945.

Petroleum.—Crude petroleum attained its highest output since 1941 with 22,824,941 barrels in 1945; 19,542,689 barrels were exported and 4,883,631 barrels refined within the country. Comparable figures for 1944 are 22,647,476 barrels produced, 18,561,431 barrels exported, 3,854,742 barrels refined.

With completion of a pipe line connecting Casabe with the line of Andian International Corp. that leads from the De Mares concession to Cartegena, the Casabe concession of Cía. de Petróleo Shell de Colombia went into full field production for export on June 6, 1945. Most of the total production, as in past years, came from the De Mares concession of the Tropical Oil Co. and the Barco concession of the Colombia Petroleum Co. Developments during the year include opening of the new Galan field in the De Mares concession and completion of seven producing wells in Shell's Dificil field in the lower Magdalena Valley. Less promising areas were opened by Socony-Vacuum at Cantagallo, Bolivar, and by Socony and Tropical in northwestern Colombia.

Refinery products were the output of the Tropical Oil Co.'s large and complete plant near Barranca-Bermeja and Colombia Petroleum Co.'s small topping plant in the Petrólea field.

ECUADOR

Gold and silver.—Operation of the gold-silver mine of the South American Development Co. at Portovelo was below normal during most of 1945 because of the break-down in January of one of the two hydroelectric plants, following flooding of the mine at the close of 1944. High operating costs have forced high-grading of the mine to meet expenses; and by the end of 1945 only low-grade ore remained, and the life of the mine was reported to be shortening rapidly. The possibility of continuing exploration work will probably be determined by the results of operation in 1946.

The Macuchi silver-gold-copper mine of the Cotopaxi Exploration Co. also operated on a reduced scale in 1945, and failure to find a new ore body forced the company to notify the Government in May 1946 that exploitation of ore would cease, probably before the end of the year.

Combined production of the above two companies amounted to an estimated 66,975 troy ounces of gold and 255,965 ounces of silver in 1945, compared with 84,234 ounces of gold and 376,565 ounces of silver in 1944.

Copper and lead.—Ecuadoran copper and lead production amounted to 3,649 and 159 metric tons, respectively, in 1945, as against 3,009 and 485 metric tons, respectively, in 1944. Nearly all of the copper is in the form of blister bars from the Macuchi smelter; the lead is contained in concentrates derived from the ores of both the Macuchi and Portovelo mines. Consequently production of copper and lead is expected to follow the downward trend of gold and silver in 1946.

Cement.—The Estero Salado plant of La Cemento National, C. A., near Guayaquil—built in 1922 and the only cement plant in Ecuador—has been operating on an upward trend since 1938 or before and has doubled its output between 1942 and 1945. The new record production of 40,617 metric tons in 1945 was a 15.7-percent advance over the previous 1944 peak of 34,691 tons. However, production continues to lag behind demand, largely because of domestic activity in highway construction, and had to be supplemented by imports from Great Britain and the United States in 1945. Ecuadoran cement exports to Peru and Colombia in the spring of 1945 have been explained by internal transportation difficulties that resulted in a temporary accumulation in excess of the company's storage capacity. The general cement shortage and the monopolistic position of the company have combined to create exorbitant prices that are said to have reached as high as 90 sucres ($6.75) per sack. Relief is seen in an announced plan to construct a new plant of 200 tons daily capacity at Riobamba, to supply the needs of the Sierra region and to utilize hydroelectric power, fuel (lignite), and raw materials that can be developed locally.

Minor industrial minerals and hydrocarbons.—Marine salt production was maintained at an adequate level, although it declined 23.2 percent from 35,958 metric tons in 1944 to about 27,600 tons in 1945. The reported 1945 production of other minerals, compared in parentheses with 1944, was as follows, in metric tons: China clay, 40 (38); geyerite, 65 (89); iron oxide, 4 (111); ocher, 6 (not reported); crude sulfur, 103 (13); natural asphalt, 3 (9); and coal, 41 (76). Quantitative production of gypsum, lime, and stone has not been reported. New mining claims filed during the year included six for china clay, seven for gypsum, and one for ocher.

Petroleum.—Crude petroleum production, as usual, was confined to the peninsula of Santa Elena and was distributed among fields as follows during the past 2 years:

Ecuador—production of crude petroleum, 1944–45

[Barrels of 42 gallons]

Field:	*1944*	*1945*
Ancon-Santa Elena	2, 151, 392	1, 966, 358
Carolina-Santa Paula	36, 249	56, 292
Concepcion	90, 839	103, 286
El Cautivo	41, 586	434, 886
El Tigre	520, 195	
El Tambo	751	832
Petropolis	125, 957	102, 072
Total	2, 966, 969	2, 663, 726

Anglo-Ecuadorian Oilfields, Ltd., accounted for all of the output from the Ancon and part from El Tigre fields; the remainder, in descending order of importance, was supplied by Ecuador Oilfields, Ltd., Concepcion Ecuador Oilfields, Ltd., International Ecuadorian Petroleum Co., Carolina Oil Co., and Petropolis Oil Co.

Shell Oil Co. completed at 5,187 feet the first test well in its 25,000,000-acre concession in eastern Ecuador. It was unproductive, but three other tests are planned for 1946. This represents the first drilling in Ecuador to explore for oil in the great llanos region east of the Andes.

In addition to crude petroleum, 38,408 barrels of natural gasoline in 1944 and 41,768 barrels in 1945 were produced in the Santa Elena district. Output of refinery products (exclusive of losses) by the three plants of Anglo-Ecuadorian at La Liberdad, Ecuador Oilfields at Cuativo, and Carolina Oil Co. at Carolina amounted to 961,215 barrels in 1944 and about 913,000 barrels in 1945.

FRENCH GUIANA

Gold.—Placer mining of gold in French Guiana has declined steadily since the beginning of World War II, due to degeneration of general conditions rather than any serious depletion of resources. United States imports of gold from French Guiana amounted to only 7,761 troy ounces in 1945 (13,224 ounces in 1944). (Exports from French Guiana in 1939 totaled 37,606 ounces). Gold mining is the only mineral industry in the colony.

PARAGUAY

Paraguay has no established mining or mineral industry. The Union Oil Co. of California, under contract with the Paraguayan Government, engaged in seismographic and gravimetric surveys of prospective oil lands throughout the year and expects to start test drilling in the Chaco of northern Paraguay in 1946.

PERU

PRODUCTION

In general, Peruvian mineral production in 1945 declined appreciably from that of 1944. Exceptions for which increases were recorded included gold, silver, mercury, and vanadium among the metals, manufactured building materials (cement, lime, calcined gypsum) and salt among the nonmetallic minerals, and coal and natural gasoline. Comparative production in the last 2 years is presented in the following table.

Summary of mineral production of Peru, 1944–45

[Metric tons, except as otherwise noted]

Mineral	1944	1945	Change (percent)
METALLIC ORES AND METALS			
Antimony	1,058	[1] 781	−25.6
Arsenic oxide (white arsenic)	6,899	6,397	−7.3
Bismuth kilograms	416,159	309,000	−25.7
Cadmium do	2,174	1,250	−42.5
Copper	32,396	[1] 28,839	−11.0
Gold troy ounces	175,180	[1] 180,402	+3.0
Lead	52,501	[1] 51,935	−1.1
Mercury flasks (76 pounds net)	152	[1] 209	+37.5
Molybdenum	62	[1] 30	−51.6
Silver troy ounces	15,832,440	[1] 16,081,833	+1.6
Tin, in dross		125	
Tungsten concentrates, 60 percent WO_3	635	[1] 317	−49.9
Vanadium	518	620	+19.7
Zinc	56,263	[1] 38,400	−31.7
NONMETALLIC MINERALS			
Aluminum sulfate	80	[1] 150	+87.5
Barite	2,352	3,000	+27.6
Clay	7,924	[1] 9,000	+13.6
Cement	248,537	[1] 255,000	+2.6
Gypsum, calcined	25,190	[1] 27,000	+7.2
Lime	82,997	[1] 100,000	+20.5
Magnesium sulfate	663	[1] 650	−2.0
Manganese sulfate	89	25	−71.9
Mica	113	[1] 20	−82.3
Mineral water gallons	1,701,266	1,717,170	+.9
Quartz and marble	3,878	6,500	+67.6
Quartzite and other rock	(2)	[1] 3,000	(2)
Salt	53,818	[1] 60,000	+11.5
Silica	(2)	[1] 8,000	(2)
Sulfur	611	[1] 650	+6.4
HYDROCARBONS			
Coal:			
Anthracite	14,545	[1] 28,000	+92.5
Bituminous	158,814	[1] 160,000	+.7
Total	173,359	[1] 188,000	+8.5
Natural gasoline barrels (42 gallons)	1,033,768	1,075,137	+4.0
Petroleum, crude do	14,385,926	13,748,228	−4.4

[1] Estimate, subject to revision.
[2] Not reported.

METALLIC ORES AND METALS

Antimony.—Some antimony mines have maintained operations throughout 1945 and are expected to continue, notwithstanding comparatively low prices. Decline in production dates from 1943, during which peak year the United States Commercial Company discontinued its antimony purchase contract. Of the total 1945 output, 269 tons was the metallic product of the Cerro de Pasco plant at Oroya.

Byproduct metals.—The 1945 decrease in output of white arsenic, bismuth, and cadmium was normal to the decrease in the smelting of copper, lead, and zinc ores, of which they are byproducts, at Oroya. During the year the Cerro de Pasco Copper Corp. started construction of a new plant at Oroya for the manufacture of calcium arsenate, for domestic sale as an insecticide to Peruvian cotton growers. The 125 tons of tin reported by the Oroya smelter (and derived from Cerro de Pasco ores) probably represented a 2-year accumulation of dross, as no production was recorded in 1944. Byproduct recovery of electrolytic tellurium and indium, started at Oroya in 1943, has not been reported for 1944–45. Oroya is also equipped to manufacture calcium carbide, sulfuric acid, and refractory and building brick.

Copper.—Peruvian production of copper in 1945 was the lowest since 1933. The trend has been downward since 1940, but the 11 percent drop from the previous year in 1945 was greater than expected, particularly in view of the fact that total United States purchases of foreign copper in 1945 were larger than in 1944. Of the 28,833 metric tons of copper in ore mined in Peru in 1945, 25,306 tons were extracted at Oroya in the form of blister bars, 206 tons in electrolytic bars, and 127 tons in matte. Construction of a copper refinery was started at Oroya by the Cerro de Pasco Copper Corp.

Gold.—The notable feature of the over-all 1945 increase in gold production is that it included a 10.7 percent increase over 1944 in gold contained in copper bars, while output of copper bars decreased 4.4 percent, indicating a rise in the average gold : copper ratio of copper ores mined. Production in other categories (content of gold-silver bars, ores and concentrates exported, and output of placers) remained about the same as in 1944, roughly 126,000 troy ounces. Official figures do not include unknown amounts of gold sold by Indian placer miners to small merchants who never report this production to the Government, thereby evading tax payments. Total gold production is expected to increase further as soon as additional mining equipment is obtainable from the United States.

Iron and steel.—The Santa Corporation (Corporación Peruana del Santa, a corporate agency of the Peruvian Government) completed the construction of extensive port works at Chimbote Bay in May 1945. A large hydroelectric power plant in Cañon del Pato and rehabilitation of the 80-kilometer Chimbote-Ancos railway were also completed during the year. Future projects of the corporation include establishment at Chimbote of an iron and steel plant planned to utilize coal exploited at Ancos and 16,000 tons of iron ore per month from deposits near the coast at Marcona, 650 miles south.

Lead.—Lead production was only slightly under that of the preceding record year 1944 and was higher than in any other year in Peruvian history. Of the total, 40,001 tons were refined in bars at the Oroya plant and 11,934 tons shipped in concentrates. Sales were principally to the United States Commercial Company. Projects of the Santa Corporation include plans to construct a small lead smelter at Chimbote to treat concentrates from plants not in Central Peru.

Mercury.—Although output of mercury increased 37.5 percent over 1944, the 209 flasks produced in 1945 were not enough to be significant. The Chonta plant (Huánuco) was the only one known to have been operated during the year; construction of a 250-ton reduction plant at the Santa Barbara mine, Huancavelica, continued. The Santa Barbara plant, when finished, is expected to make possible the exploitation of a large reserve of low-grade ore.

Molybdenum.—Peru Molibdeno, S. A., the only important producer of molybdenum in Peru, closed its concentrator in October 1944 and later resumed operations for about 3 months, until minable ore was exhausted and its contract with the United States Commercial Company was canceled. In August 1945 the company was liquidated and all mining, concentrating, and other equipment sold. The only other producer, the Salazar mine, is operated on a very small scale.

Radioactive minerals.—Development of the atomic bomb has stimulated an active search for radioactive minerals in Peru by prospectors, mining companies, and Federal agencies. On September 18, 1945, the Ministerio de Fomento announced that all rare and radioactive mineral deposits in the Provinces of Costillas, Condesuyos, and Caravelí, Department of Arequipa (some of which have been known for several years), have been declared reserved for the State.

Silver.—The moderate rise in silver production was brought about by increased output of silver in shipping concentrates and in silver and gold-silver bars, which more than balanced the decrease in silver-carrying copper bars and resulted in the largest silver production since 1940. In 1944–45 Peru surpassed Canada and became the world's third largest producer of silver, exceeded only by Mexico and the United States. However, this advance in relative position was brought about by Canada's excessive decline rather than by spectacular gains in Peru. The United States increase in the purchase price of foreign silver from $0.4475 to $0.71111 per ounce, announced September 20, 1945, by the Office of Price Administration, was good news to producers throughout the world, and its stimulating effect on the dozen or more gold-silver mines in Peru should be more evident in 1946. Domestic sales to Peruvian silversmiths have greatly increased since the beginning of the war, reaching 1,092,289 ounces in 1943 and 1,576,351 ounces in 1944 (1945 figures not available), with a parallel rise in domestic and export sale of hand-worked silverware. The Cerro de Pasco Copper Corp. at Oroya is the only producer of refined silver bars.

Tungsten.—The sharp decrease in production of tungsten concentrates, most of which came from the mines of Fermin Malaga Santolalla i Hijos, was a normal reflection of a similar decrease in demand in the United States, which dates from VJ-day. Presumably the concentrates were the product of beneficiation at the Peruvian Government's tungsten concentrator near Callao.

Vanadium.—The new $4,000,000 plant at Junasha, built with Defense Plant Corporation funds and operated by the Vanadium Corp. of America, using low-grade ores from Minaragra, was completed near the beginning of 1945 but did not attain full mechanical operation until June. A number of mechanical defects in the plant have been corrected, but considerably more improvement will have to be made before production of V_2O_5 comes close to preconstruction expectations. Meanwhile, the old plant continues treatment of higher-grade ores at the monthly rate of about 2,500 tons. Combined vanadium output of the two plants in 1945 resulted in an increase of only 102 tons over that of the old plant alone in 1944.

Zinc.—While the decline in lead production from 1944 to 1945 was less than 600 tons, that of zinc, according to preliminary figures, was about 17,800 tons. Production in 1944 was a surprising record, however; and the relatively reduced output in 1945, estimated at 38,400 tons, appears to be nevertheless the second highest in the history of Peruvian zinc mining. The Santa Corp. proposes to establish a zinc concentrator and electrolytic refinery of 75 or 100 tons daily refined zinc capacity at Chimbote, to cut exports of zinc in the form of concentrates. Revival of similar plans by the Cerro de Pasco Copper Corp., postponed by the recent war, have not been announced.

NONMETALLIC MINERALS

Barite.—Barite first appeared on Peru's list of industrial minerals in 1944, with production of 2,352 tons; an increase to 3,000 tons in 1945 was estimated. Sales are confined to local consumers.

Calcined materials.—Continued activity in the construction of highways and buildings raised cement production an estimated 6,500 tons in 1945. Output of Cía. Peruana de Cemento Portland, the sole producer, was insufficient to meet domestic demands and had to be supplemented by imports. Consumption of cement (not reported for 1945) has risen steadily in Peru from 160,000 tons in 1939 to 246,000 tons in 1944. Calcined gypsum (plaster) and lime production are governed by the same demand factors as cement and rose accordingly.

Mica.—Of the three companies that started mining mica in southern Peru in 1943, only the Cía. Peruana de Mica continued operations into 1945. Trimmed and scrap mica were sold to private buyers in the United States after February 28, when the contract with the United States Commercial Company expired.

HYDROCARBONS

Coal.—The bulk of the 1945 gain in coal production was in anthracite and represents the beginning of what is expected to become a much greater expansion in the development of the Ancos deposits that lie inland from Chimbote and are connected with that port by an 80-kilometer narrow-gage railroad. Cía. Carbonera Pallasca and Cía. Carbonera Ancos have recently completed the construction of coal-cleaning plants at their respective properties. The total present capacity of the coal cleaning and sizing facilities of the district is roughly 250 tons daily, and the potential capacity of the mines is much greater. The district is expected to supply fuel for the iron, steel, chemical, and general manufacturing industries envisioned for the Chimbote area and to increase the sale of Peruvian coal for export.

Petroleum.—Production of crude petroleum in 1945 receded by nearly 638,000 barrels to about the level of 1942. Distribution of production was as follows: International Petroleum Co. (La Brea-Pariñas fields), 11,278,387 barrels; Cía. Petrólera Lobitos (Restin-El Alto fields), 2,263,506 barrels; Peruvian Government (Zorritos and Los Orangos fields), 141,065 barrels; and Cía. Petróleo Ganso Azul

(Agua Caliente field), 65,270 barrels. In addition, natural gasoline was produced as follows: International Petroleum Co., 957,991 barrels; and Cía. Petrólera Lobitos, 117,146 barrels. The International Petroleum Co. produced 13,103,268 barrels of refinery products at Talara, the Peruvian Government 305,524 barrels at Villar, and Cía. Petróleo Ganso Azul 65,303 barrels at its field topping plant, making a total of 13,474,095 barrels of refinery products, of which 212,737 barrels represented residue fuel oil, still gas, and losses. Of these total outputs, 272,488 barrels of crude oil and 8,941,179 barrels of refinery products were exported. Peruvian consumption of refinery products amounted to 4,880,239 barrels.

SURINAM (NETHERLANDS GUIANA)

The liberation of Holland and prospects of an early resumption of trade brightened the economic outlook of Surinam considerably in 1945. Noticeable gains have been made, and conditions during 1946 should improve steadily.

Bauxite.—Exports of bauxite amounted to 683,990 metric tons in 1945—far below the 1943 peak, but 58,186 tons ahead of 1944. Surinamsche Bauxite Maatschappij (Alcoa) shipped 87 percent of the total from its plants at Paranam and Moengo; the remaining 13 percent was sold to Alcoa by N. V. Billiton Maatshappij of Smalkalden. Of the total shipped, 225,049 metric tons went to the stock pile at Trinidad and 458,941 tons went to the United States, including 4,877 tons to manufacturers of refractories. The total also included 16,786 metric tons of high-grade chemical bauxite. Billiton canceled its plans to suspend operations at the close of 1945.

Gold.—Placer gold production in 1945, although amounting to only 5,895 troy ounces, showed a slight improvement over both 1944 (5,723 ounces) and 1943 (5,795 ounces). Output is from two organized companies, Sara Creek Mining Co. and White Water Mines, Ltd., and numerous independent operators.

Granite.—The Department of Public Works operates a granite quarry at Fedra as a source of material for construction and repair of streets in Paramarito, 45 miles to the north. Tonnage crushed has not been reported for 1944 or 1945.

URUGUAY

Since 1942, when gold mining dwindled to insignificance, the mineral industry of Uruguay has been confined to the production of nonmetallic mineral raw materials, chiefly for use in construction. Sand and gravel output amounted to 2,586,039 metric tons (2,333,918 sand, 252,121 gravel) in 1945, compared to 2,777,128 tons (2,569,578 sand, 207,550 gravel) in 1944. Rarely important in foreign trade, more than half of that produced in Uruguay is regularly exported to Argentina, but this trade may be restricted by Argentina in 1946 to permit development of its own deposits. Ground quartz for special use in glass making was also produced to the extent of 1,357 metric tons in 1945 and 1,457 tons in 1944, of which 843 tons in 1945 and 904 tons in 1944 were exported.

Of the 390,432 tons and 303,989 tons of limestone quarried in 1945 and 1944, enough was calcined to produce 185,290 tons and 165,990 tons of cement, in the same years, respectively, by the two cement plants at Montevideo and Nueva Carrera. Cement exports amounted to 8,504 metric tons in 1945 (25,199 tons in 1944). Gypsum required for cement production is imported normally from Argentina, although at present and apparently for political reasons exports of gypsum and salt from Argentina to Uruguay are prohibited, and Uruguay's source of gypsum in 1946 probably will be American-occupied Germany. Salt requirements are expected to be filled by imports from Spain.

Uruguayan production of stone for building and construction purposes, aside from limestone in excess of that used for cement and small quantities of curb, flag, and paving stone, was as follows in 1945, with equivalent figures for 1944 in parentheses: Rough stone, 8,874 (28,638) tons; marble, 33,360 (16,440) tons; ballast, not reported (111,471 tons). Exports, chiefly to Argentina and Brazil, were rough stone, 1,259 (4,063) tons and marble, 1,183 (583) tons.

Output of refractory clay dropped from 2,144 metric tons in 1944 to 1,592 tons in 1945. About one-third of the output was exported in each year. Production of common clay, amounting to 19,300 tons in 1944, was not reported in 1945. Production of talc, used by the paper industry and by manufacturers of soap and talcum powder, declined from 2,257 tons in 1944 to 1,823 tons in 1945 and exports from 1,861 to 1,503 tons. Feldspar and mica output, amounting to 264 and 3 tons, respectively, in 1944, was not reported in 1945.

VENEZUELA

METALS

Gold.—Venezuelan production of gold has been reported as 77,716 troy ounces in 1944 and 76,839 ounces in 1945. Believed to average 760 fine, as reported in 1941–43, output thus appears to have amounted to only 59,064 ounces in 1944 and 58,397 ounces in 1945 when reduced to fine gold. In March, New Goldfields of Venezuela, Ltd., took over operation of the properties of Cía. Francesa de la Mocupia in addition to its own, and the combined mines, near Guasipati in the State of Bolivar, supplied 78 percent of the total output. The remaining 22 percent came from the Vuela Caras mine in the same district and from placer workings, mainly in the Caroni region. New Goldfields of Venezuela, Ltd., continued to show an operating loss despite the removal of wartime restrictions against procurement of equipment and supplies and faces a depressing future unless costs can be greatly reduced.

Iron.—Throughout the year Iron Mines Co. of Venezuela (Bethlehem Steel) continued preparations to develop its iron-ore reserves at El Pao, 30 miles south of San Felix, but has not as yet started mining. A small island off the coast of Trinidad has been selected for the site of the loading station. Work continued also on construction of a fleet of 4 ore ships, the first of which (the *Venore*) was launched January 22.

Nickel.—The International Nickel Co. continued examination of a garnierite deposit at Lorno de Hierro, near San Pedras, but a report of results has not been received.

Uranium.—Interest in exploration for deposits of radioactive minerals has been stimulated in Venezuela, as elsewhere, by the wartime developments in the controlled use of atomic energy. Discovery of pitchblende and a sample tentatively identified as calciocarnotite have been reported from the State of Merida—one from the Cerro Santa Lucia northwest of Timotes and the other from about 1 kilometer northeast of the city of Merida. On October 13, 1945, the Ministro de Fomento issued Decree 339 declaring that no exploration for or exploitation of radioactive minerals can be undertaken without special permission of the Venezuelan Government.

Vanadium.—During 1945 the United States imported 133,795 pounds (61 metric tons) of flue dust containing 46,952 pounds (21 metric tons) of V_2O_5 from Curaçao. This represents material derived from crude petroleum of Venezuelan origin, though only a portion of the total available from that source.

NONMETALLIC MINERALS

Asbestos.—Cía. Anónima Minas de Amiante de Tinaquillo started operation, late in the year, of its asbestos mill west of Tinaquillo, State of Cojedes, but did not achieve a full production rate. Tonnage produced has not been reported but is believed to be small.

Cement.—At the end of 1944 Cía. Cemento Portland National operated the only two cement plants in Venezuela, at Caracas and Valencia, having a combined annual capacity of 120,000 metric tons. During 1945 two new plants began operations, one (ownership not reported) at Merida, with an annual capacity of 15,000 tons, and the other built by Cía. Venezolana de Cemento at Barquisimeto, with an annual capacity of 40,000 tons. Cement production increased from 119,670 metric tons in 1944 to a new record high of 124,447 tons in 1945 and is expected to continue upward for the next few years. Cía. Venezolana de Cemento plans to complete a 90,000-ton plant at Maracaibo in 1946 and another of equal size at Pertigalete in 1942. E. P. Haliburton, an American industrialist, proposes to erect a 125,000-ton plant at Chichiriviche, to be completed by mid-1946. If all of these plans materialize, the Venezuelan annual cement capacity will be 480,000 tons by early 1947, as against a growing annual demand that had reached about 300,000 tons by the end of 1944. Limestone, gypsum, and clay are obtainable locally, as is oil for fuel, and Venezuela may well attain self-sufficiency in cement within the next few years.

Diamonds.—The production of diamonds dropped 42 percent, from 22,037 carats in 1944 to 12,769 carats in 1945, the smallest output since 1939. Production by districts was as follows:

Diamond production, State of Bolivar, Venezuela (carats)

Producing areas:	*1944*	*1945*
Lower Caroni-Paragua Basin	5, 128. 15	2, 414. 28
Upper Caroni Basin (Gran Sabana)	16, 691. 62	10, 228. 00
Cuyuni and Mazaruni Basins	217. 30	126. 60
Total Venezuela	22, 037. 07	12, 768. 88

The 42-percent drop reflects the closing of the gap between supply and demand for industrial stones during the last year of the war.

Other nonmetallic minerals.—Recovery of salt from sea water, estimated at 25,000 tons in 1944, amounted to 44,166 metric tons in 1945, the highest since 1940. Principal production is on the Araya Peninsula, State of Sucre, and is for domestic use only. La Industria Nueva Esparta, C. A., mined 5,600 metric tons of crude magnesite on Margarita Island in 1945, compared with only 700 tons in 1944 and 589 tons in 1943. The company uses this raw material for the manufacture of calcined products in its plant in Caracas. Quantitative production of limestone, lime, gypsum, clay, sand, and gravel has not been reported.

HYDROCARBONS

Coal.—Mine output of coal, never significant in Venezuela, dropped from 12,473 metric tons in 1944 to 7,022 in 1945, of which 4,957 tons was from the Government mine at Naricual and 2,065 tons from the Corcobado mine of Hulleras de Guárico near Altagracia.

Petroleum.—The close of the war in midyear failed to curb Venezuelan production of crude petroleum, which rose from the previous peak of 257,045,668 barrels in 1944 to a new record of 323,414,505 barrels in 1945, for a remarkable increase of 25.8 percent. Sustained demands for war during the first half of the year, continued absence of the Netherlands East Indies and Central Europe from world markets, and curtailment of production in the Near East were factors to which the increase was largely attributed. As in 1944, 95 percent of the total output was supplied by the three largest producers: Creole Petroleum Corp. (Standard Oil of New Jersey), Mene Grande Oil Co. (Gulf Oil Corp.), and the Shell Oil Co. (through its subsidiaries Caribbean Petroleum Co., Venezuelan Oil Concessions Ltd., and Colon Development Co., Ltd.); the remainder came from Consolidated Petroleum Co. (Sinclair Oil Co.), Socony-Vacuum Oil Co., Texas Petroleum Co., British Controlled Oilfields Ltd., Orinoco Oil Co. (Pure Oil Co.), Venezuelan Atlantic Refining Co., and S. A. Petrólera Las Mercedes. Production is divided between the larger Western district, which includes the Lake Maracaibo basin, and the Eastern district in the States of Monagas and Anzoategui and the Territory of Delta Amacuro. Discovery by the Texas Petroleum Co. and affiliates of fields at Los Mercedes in Guarico indicate the possibility of a third Central district, and an extended exploration program is scheduled there as well as in the other two. Under the Petroleum Law of March 13, 1943, the holders of exploration concessions have a period of 3 years in which to select not more than 50 percent of their exploration acreage, the remainder to revert to the Government as national reserve; in most instances less than 2 years remain, and all companies are working against time. Companies engaged in exploration, in addition to the producers listed above, include the Philips Petroleum Co. (first producing well completed in May 1946) and the Richmond Exploration Co. (Standard Oil Co. of California). Venezuela is the world's second largest producer of crude petroleum, and the present high level of output is expected to be well-maintained throughout 1946.

Refinery throughput amounted to 32,645,515 barrels in 1945, distributed among the following six companies through their eight refineries: Creole Petroleum Corp. at La Salina and Caripito, Caribbean Petroleum Co. at San Lorenzo, Mene Grande Oil Co. at Cabinas and

Oficina, Colon Development Co., Ltd., at El Cubo, Socony-Vacuum Oil Co. at Guario, and British Controlled Oilfields, Ltd., at El Mene de Mauroa. Plans for new refineries in accordance with the Government program agreed upon in 1943 include: Creole Petroleum Co., a 40,000-barrel plant, probably on the Paraguana Peninsula; Shell Oil Co., a 40,000-barrel plant now under construction at Punta Cardon, Paraguana Peninsula; Consolidated Petroleum Co., a 40,000-barrel plant at Puerto La Cruz; and Mene Grande Oil Co., a 20,000-barrel plant at Puerto La Cruz.

A new decree, applying to 1946 only, imposes an excess-profit tax of 20 percent on all individuals and corporations whose profits exceed $560,000; 15 percent on $400,001–$560,000; 10 percent on $280,001–$400,000; and 6 percent on $225,001–$280,000. Most of the oil producers in Venezuela will be in the 20-percent bracket.

AFRICA [10]

By Frank L. Fisher

The African mineral-producing countries responded satisfactorily to the shift from war to peace conditions. Gold production in 1945 took an upward trend toward the close of the year for the first time since a gradual decline started in 1941, although total annual production in 1945 was slightly less than in 1944. Diamond production reached a new high, and base-metal production remained consistently good through the year. A sharp decrease in the intensity in the search and exploitation of strategic materials was noted.

The Union of South Africa, Belgian Congo, Northern and Southern Rhodesia, British West Africa (Nigeria, Gold Coast, and Sierra Leone), and French North Africa (Algeria, Morocco, and Tunisia) continued as the countries of major importance in dollar value of minerals produced during 1945. The mineral industries of Angola, Bechuanaland, British East Africa (Kenya, Uganda, Tanganyika), Egypt, French Equatorial Africa, Madagascar, Mozambique, and South-West Africa were of secondary importance in 1945. The remainder of Africa, comprising countries with over half of the land area, has no significant mineral production, except for primitive mining of gold and salt, and includes Anglo Egyptian Sudan, British Somaliland, Cabinda, Eritrea, Ethiopia, French Somaliland, French West Africa, Gambia, Italian East Africa, Liberia, Libya, Rio de Oro, Rio Muni, and Spanish Guinea.

UNION OF SOUTH AFRICA

The Union of South Africa suffered very little by World War II, and gold production in the Union for 1945 amounted to 12,213,545 fine ounces, a decrease of 63,683 fine ounces from the 1944 yield.[11] The Transvaal Chamber of Mines reported a decrease for its member mines in average recovery a ton from 0.202 fine ounce in 1944 to 0.199 fine ounce in 1945. Working costs continued to rise to $4.73 a ton of

[10] Unless otherwise indicated, statistics for all countries in Africa are in metric tons.
[11] Abstracted from information supplied by William O. Vanderburg, American minerals attaché, Pretoria, South Africa.

ore as compared to $3.96 a ton of ore for 1939. Gold-mine dividends decreased to 52 million dollars for 1945.

A report was issued during the year on deep-level mining, and the reserves locked up in deep-level mining on the Central Witwatersrand were estimated at nearly 800 million dollars. The present methods of wet mining with modifications and with refrigeration are believed adaptable between 8,500 and 10,000 feet, but below that depth it is necessary to resort to dry methods of mining.

Coal output of the Union of South Africa in 1945 was 25,465,584 tons, with exports amounting to 4,511,896 tons—almost a 100-percent increase over 1938. The Union also had an increased output of blister copper, corundum, fluorspar, vermiculite, and iron ore in 1945 compared with the previous year and a decreased output of manganese ore, chrome ore, tungsten concentrates, antimony, and mercury.

BELGIAN CONGO

Gold production declined further, as transition back to this type of mining was not realized fully enough in 1945 to check the downward trend. The 381,206 fine ounces produced in 1945 was 174,198 less than the 1940 production. The production of industrial diamonds and gem stones, primarily from the Beceka field, was a peak 9,927,340 carats of industrials and 459,000 of gem stones. This compares to 7,144,552 carats of industrials and 388,814 of gem stones produced in 1944. Copper production continued at a normal rate, with 160,200 tons reported for 1945, which brings the total production since operations began in 1925 to nearly 3 million tons. A sharp increase in cobalt production to 7,250 tons of white alloy was reported for 1945. Tin production also reached a new high in 1945, with 24,099 tons of cassiterite produced, having a metal content of 17,351 tons of contained tin.

NORTHERN AND SOUTHERN RHODESIA

Northern Rhodesia maintained its position as the principal base metal producer on the African continent in 1945.[12] Copper production continued the decline from that of the peak year 1940, when 262,394 long tons of metal were produced. Production of cobalt alloy, a by-product of the copper operation, showed an over-all increase during the war, as did lead, zinc, and vanadium from the Broken Hill district.

Production of gold in Southern Rhodesia in 1945 declined 24,488 fine ounces from the previous year to 568,241 fine ounces, continuing the steady decline since 1940. Southern Rhodesia produced 56,348 short tons of asbestos, a slight decrease under the preceding year, and 205,382 short tons of chrome ore, which was a sharp reduction from the 305,398 short tons produced in 1944. Minor production of mica, tin, tungsten, and silver were also reported. Coal production decreased slightly to 1,839,583 short tons from 1,992,678 short tons in 1944, the bulk of the production coming from the Wankie deposits.

BRITISH WEST AFRICA

Gold Coast.—Diamond production dropped to 812,451 carats in 1945 after a record of 1,165,858 carats in 1944. Gold production dropped 59,080 fine ounces from 1944 to a total of 475,407 fine ounces

[12] Abstracted from information supplied by William O. Vanderburg, American minerals attaché, Pretoria, South Africa.

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for 1945. Manganese exports were over 500,000 tons for the year, of which about 60 percent was metallurgical grade; and bauxite production was normal, with 148,539 tons.

Nigeria.—Tin ore production in Nigeria was approximately the same as in the previous year, when over 17,000 tons of 73.5 percent tin were produced. Production of columbite continued at peak rate throughout the year, and coal production also kept the 1944 rate of over 600,000 tons.

Sierra Leone.—Diamonds and ferro-alloy minerals continued to be the principal minerals produced in 1945 from Sierra Leone. Actual production statistics have not been released, but it is estimated that diamond production will exceed 500,000 carats, while production of iron ore was limited to shipping and storage space available.

FRENCH NORTH AFRICA

Algeria.—The continued drought and the lack of assistance from France stalemated the mineral industry of Algeria in 1945. Iron and phosphate production in 1945 was up to the limit of the technical capacity of the two industries under prevailing conditions. Phosphate production for the year exceeded 300,000 tons.

French Morocco.—The total production of dried raw phosphates was approximately 1,635,000 tons, an increase over the 1,444,902 tons produced in 1944. Coal production increased 33,000 tons over the preceding year for a total of 180,000 tons for 1945. The manganese mines produced 42,000 tons compared with 27,550 tons in 1944. Production of lead ore totaled 15,500 tons, compared to 13,500 tons for the previous year, and petroleum production continued to decline sharply, with a 1945 production of less than 3,500 tons. Small, relatively unimportant quantities of cobalt, zinc, copper, graphite, and asbestos were also extracted during 1945.

Tunisia.—The mineral industry of Tunisia progressed slowly during 1945 in approaching the prewar average production levels of 1,800,000 tons of phosphate rock, 800,000 tons of iron ore, and 30,000 tons of lead ore. Production had reached 50 percent of the average production of phosphate and 15 percent of the iron ore as the year ended.

OTHER COUNTRIES

Angola.—Mineral production in Angola was confined primarily to diamonds, gold, and asphalt. Statistics for 1945 are unavailable but are not expected to vary from the 1944 production statistics.

Bechuanaland.—Mineral production in Bechuanaland in 1945 was 11,299 fine ounces of gold and 1,236 fine ounces of silver, which was approximately the same as the previous year.

British East Africa (Kenya, Tanganyika, and Uganda).—The highlight for British East Africa (Kenya, Tanganyika, and Uganda) production in 1945 was the continued increase in output of Tanganyika diamonds and Kenya soda. The output of soda ash in Kenya from Lake Magadi paralleled the value of the yearly production of gold in 1945, with an increase of 9,250 tons over 1944 for a record production for 1945 of 72,163 tons of soda. Production of diamonds in Tanganyika continued to increase in 1945, with an exported total of 115,660 carats. Gold production increased to 90,633 fine ounces compared to the 1940 peak of 143,694 fine ounces. Sharp declines were reported in production in Uganda for several strategic minerals.

Egypt.—Mineral production in Egypt continued to progress favorably during 1945, with increased emphasis on structural materials. Petroleum production increased to 1,349,473 tons for 1945, and important productions of cement, gypsum, phosphate rock, and iron oxide were reported.

French Cameroun.—Mineral production in the French Cameroun declined in 1945, with a production of 165 tons of tin concentrate, 17,880 fine ounces of gold, and 1,040 tons of rutile.

French Equatorial Africa.—Gold production in French Equatorial Africa was normal in 1945, with a production of 83,669 fine ounces. Diamonds showed a sharp increase to 82,849 carats, an increase over 1944 of 24,849 carats. An insignificant production of lead and zinc was also reported for the year.

Madagascar.—Mining operations in Madagascar for mica, corundum, and graphite declined considerably during 1945. Gold production increased for the year. Madagascar also reported a production of quartz crystals, beryl, and semiprecious stones.

Mozambique.—There were no particularly noteworthy developments in Mozambique during 1945. The 1945 mineral statistics are not available at this writing, but they are not expected to deviate from the 1944 figures.

South-West Africa.—Production of diamonds in South-West Africa continued at an annual rate of over 150,000 carats in 1945. Production of vanadium ore increased from 3,423 long tons in 1944 to 3,930 long tons in 1945 while tin increased from 74 long tons to 267 long tons for the same years.

Spanish Morocco.—Spanish Morocco iron-ore exports in 1945 from the Melilla deposit were 717,856 tons compared to the prewar normal of 1 million tons and a production of 780,408 tons of 61 to 65 percent ore for 1944. Spanish Morocco also reports exports of 125 tons of 70-percent lead ore, 325 tons of antimony concentrate, and 250 tons of graphite during 1945.

EUROPE [13]

By Frank L. Fisher

The European mineral industry in 1945 made slight progress against extreme handicaps. The bomb damage through actual warfare was slight, possibly less than 10 percent. The most serious direct effect of the war on the mineral industry is the extreme overexploitation by the Nazis, in which any future operation of the deposit was disregarded. The second problem in 1945 was the general deterioration of equipment and the dire shortages of mine supports. The third major problem that hindered rejuvenation of the European mineral industry was the labor shortage and the failure of the nations to evolve any immediate plan to successfully employ captive labor. Two reasons why the men were not overanxious to work in the mines were the hazardous condition and the economic chaos of inflation.

The fourth major problem was the complete break-down of transportation and the necessity of permitting transportation on a priority basis when restoration was effected. The fifth major problem was

[13] Unless otherwise indicated, statistics for all countries in Europe are in metric tons.

the necessity of providing food and fuel to the peoples of Europe to enable them to be physically able for industrial work.

BELGIUM

Belgian industrial economy centers around the availability of coal. War conditions had cut the production to considerably less than 2,000,000 tons a month as compared to a monthly prewar average of 2,500,000 tons. The recovery trend became noticeable in September 1945, and in December of that year a production of 1,732,370 tons was obtained during the 24-day work month.

Belgium had 47 blast furnaces in operation in 1937 and an average monthly prewar production of 264,300 tons of pig iron, 252,600 tons of crude steel, and 193,100 tons of finished steel. The iron and steel industry had recovered to the extent that, in December 1945, 22 blast furnaces operated to obtain a production of 129,800 tons of pig iron, 132,100 tons of crude steel, and 100,800 tons of finished steel. In addition, Luxembourg had 10 blast furnaces in operation, with a December 1945 production of 72,000 tons of pig iron and 56,000 tons of crude steel.

The nonferrous metals industries recovered at a much slower rate in 1945 than the ferrous industry, largely owing to small allocations of coal and the difficulty in obtaining supplies of foreign ores. Resumption of normal shipments of copper matte from the Belgian Congo, zinc ores from Mexico, Australia, and Sweden, and lead ores from Yugoslavia, South America, and Sweden are not expected to begin until 1946. The nonferrous metal industry was producing at a monthly rate, in November 1945, of 180 tons of crude copper, 2,400 tons of crude zinc, and 670 tons of crude lead. The Antwerp diamond-cutting industry appeared to be staging a satisfactory recovery.

FINLAND

The Finnish mineral statistics for 1945 are not available at this time. The Outokumpu Copper Co. announced plans during the year to increase the annual capacity of its plant from the present 600,000 tons of ore. A new copper deposit was discovered during the year at Luikonlahti, Kaavi, and a talc deposit of significance was discovered at Leppalahti in Liperi. The loss of the nickel-copper deposit at Petsamo to U. S. S. R. was a severe blow to the Finnish mineral industry.

FRANCE

The general economic condition of the mineral industry in France registered slow improvement in 1945 until October when a decline set in which continued throughout the remainder of the year.[14] One of the primary effects of the German occupation was a complete scavenging of French metal and mineral stocks and an intensive exploitation of deposits. It was not possible to replenish stocks, and stocks on hand during the year have been extremely low.

Lead and zinc.—Lead production (lead content of ores and concentrate) in 1945 was 7,527 tons compared to 3,528 tons of ore in 1944 and 4,220 tons of ore in 1938. Imports of lead ore began in October and amounted to 18,309 tons for the year, about half the 1938 imports.

[14] Abstracted from Ducoté, Charles H., Review of Economic Conditions in France—1945: Rept. 208, Paris, Feb. 18, 1946, 145 pages.

Smelter production of metallic lead in 1945 was 4,832 tons of pig compared to 42,183 tons for 1938. Zinc-ore production (zinc content of ores and concentrate) was 6,599 tons compared to 2,387 tons for 1944. Production of metallic zinc was 8,064 tons in 1945, reflecting a steady decline in the war years from a production of 54,713 tons in 1938.

Bauxite and aluminum.—The firmly established French bauxite industry reached a peak in 1943, with over 900,000 tons. Production of both bauxite and aluminum was steady in 1945, and these industries were two of the few to approach their prewar output at the end of the year. Bauxite production climbed to about 30,000 tons a month by the end of the year, and monthly production of aluminum averaged 3,500 tons. Over 80 percent of the bauxite continued to come from deposits near Brigoles, Department of Var. The aluminum plants suffered only slight damage from the war.

Potash.—The recovery in the important potash mines was rapid, and in December production had reached 186,630 tons with a 1945 total of 852,732 tons. The mines were operated during the war by the German "Pruessag" and in 1942 attained a production record of 129.4 percent of the 1938 production. Some of the mines escaped with slight war damage, several required 2 to 5 months for repairs, and the Ensishein and Anna mines will require 2 years before the seriously damaged plants can operate again.

Iron and steel.—Iron-ore production in France during 1945 totaled 7,824,136 tons. By comparison, the 1938 production was approximately 33 million tons. About 96 percent of the iron ore came from the Lorraine Basin. France was fifth among the world steel producers before the war and had approximately 200 furnaces, with a capacity of 12 million tons a year, which enabled France to export 20 to 30 percent of the production. The 1945 steel production capacity was about the prewar normal because it suffered practically no war damage but production was down to nearly 10 percent of the normal.

Coal.—The availability of coal held the keynote to the industrial rehabilitation of France in 1945. Strenuous efforts resulted in increasing production which in December reached 3,542,000 tons, approximately the 1938 monthly average. Output per man-shift underground, however, was only 74 percent of the 1938 average, a decrease attributable to the relatively large infiltration of German prisoners-of-war. The total increase in underground workers for 1945 was 61,000, of which 35,000 were prisoners. Coal consumption was only 57 percent of the 1938 normal because of restrictions and general curtailment regulations.

Petroleum.—France imported over 96 percent of the country's petroleum requirements before the war. The French petroleum industry suffered considerable war damage from sabotage and bombings. Approximately 30 percent of the refining capacity and about 60 percent of the storage capacity were completely destroyed. The petroleum-transportation facilities were destroyed to an estimated over-all 50 percent. The production of refined petroleum products in 1946 may reach 50 percent of the prewar normal, but complete recovery for the industry is expected to evolve through a proposed 10-year restoration plan.

Other metals.—The four copper refineries produced 9,607 tons of refined copper in 1945 from ores, matte, blister, and scrap. Several small antimony deposits were worked during 1945 resulting in a production of 2,011 tons of ore used primarily in the manufacture of oxide and 421 tons of metal were obtained from domestic and North African ores. Pyrite production was normal during the year, with a total of 146,615 tons.

GERMANY

The summary of the German mineral industry in 1945 is integrated with a nation engaging in and defeated at modern war. The industry was subjected to years of dilated imports and abnormal foreign trade, overexpanded and heavily subsidized domestic production, and finally marked depletion of resources and exhaustion of the physical structure of the mineral industry itself. A study of the state of the German mineral resources in 1945 indicates that any economic revival will be slow, regardless of the form of government, the policies, or the reparations levied upon Germany. The foundation of German industrial might has been the importation of essential materials, the encompassing chemical industry, and heavy, uneconomic, Government subsidy. The division of Germany into zones of occupation, governed by four separate Allied Nations, resulted in the elimination of any or all of the pillars of German industrial might to the extent that the foundation is now so weakened that the mineral economic structure cannot be rebuilt firmly, if it is possible for it to exist at all.

During the first 45 years of the 20th century, Germany spent 10 years engaged in active warfare, 15 years in extensive military preparation, and 14 years in complete economic disruption resulting from the pan-Germanic militarism. This has taken a tremendous toll of German mineral resources.

Germany actually had legitimate resources of lead and zinc; ample resources of iron ore; a substantial supply of copper; excellent resources of fluorspar, barite, gypsum, pyrite, graphite, and sodium, potassium, and magnesium salts; sufficient bituminous and brown coal; and the minor metallics, china clay, talc, diatomite, fuller's earth, and borax, in quantity.

At the start of World War II, Germany lacked the ferro-alloy minerals—manganese, chrome, tungsten, and molybdenum; had a major deficiency in mercury, tin, nickel, cobalt, gold, silver, and platinum; only one small, unimportant bauxite deposit; insignificant sources of natural abrasives; literally no industrial diamonds, mica, asbestos, or phosphates; and inadequate petroleum resources.

Systematic looting of the conquered countries temporarily prolonged the dwindling supplies, but by 1943 the stocks of tungsten, molybdenum, and manganese were exhausted. In 1945, at the close of World War II, reserves of domestic mineral resources were found to be noticeably depleted; surface equipment was sorely in need of repair, and many plants were badly damaged or destroyed.

The lifeblood of the German industrial machine was the foreign trade in metals and minerals, upon which Germany depended to exist as an industrial empire. The machinery for this industrial empire was the large, highly integrated industrial enterprises. The cessation of foreign trade and the partition of Germany by the zones of occupation in 1945 completely paralyzed the mineral industry.

GREECE

Famine and other ravages of war and the 3½ years of German occupation completely demoralized the mineral industry of Greece in 1945. The Germans had actively exploited the chrome, nickel, and bauxite deposits and left a trail of destruction, pillage, and looting. The general domestic political unrest also became a factor in the Greek industrial decadence throughout the year. Mineral statistics for the year have not been made available.

HUNGARY

Only meager information of the Hungarian mineral industry was available for 1945. The important bauxite industry depends on an export market, and no stable market was available to absorb the production during the year. The German overexploitation during the years of occupation resulted in a 1942 peak production of 1,038,000 tons of bauxite. The petroleum industry produced 655,657 tons of crude oil in 1945, a decrease of 19 percent from 1944. Coal production was 4,000,000 tons during the year, approximately half of the production for Hungary in 1938.

ITALY

An appalling situation of distorted economics, dating back to the years of the self-sufficiency doctrines of Fascism, continued to grip the mineral industry of Italy in 1945.[15] Italy is far from rich in mineral wealth. Excluding quarry products, it is self-sufficient only in sulfur, mercury, iron pyrites, zinc, and bauxite. Italy is extremely deficient in solid and liquid fuels. The Fascist policy artificially expanded the mineral industry, employing 136,000 persons to attain maximum production, regardless of economy, by artificial prices, control of stocks, and Government ownership of mining enterprises. Postwar reconversion will also be seriously handicapped by the loss to Italy, by ceding to Yugoslavia, of the main Italian bauxite fields and the largest subbituminous coal field in Italy.

The output of minerals produced in 1945 was 35 percent of their 1938 volume. The only mineral to exceed the 1938 production was sulfur ore—ground, which is a 30-percent sulfur rock now used as an insecticide. Mercury, tin concentrate, and crude sulfur were the only minerals exported in 1945. Coal production from Sardinia was 558,723 tons of semibituminous. The Sardinian coal mines increased production during the year from 33,400 to 65,000 tons a month. The output of rock asphalt for road construction made noticeable progress, with an output of 138,472 tons in 1945.

Sulfur production from Sicily attained 30 percent of the total for 1939, with a production of 53,690 tons. The pyrite industry reached 20 percent of the prewar production level at the end of 1945, with a monthly rate of 15,000 tons. The bauxite and iron-ore mines were relatively inactive during the year, with a production of 2,584 tons and 49,256 tons, respectively. Mercury mines produced at the rate of about 100 tons of metal a month. The Sardinian lead smelter began operations in December 1945, and conditions in the lead and zinc industry were expected to improve. Italy also reported small produc-

[15] Abstracted from information received from C. A. Botsford, American mineral attaché, Rome, Italy.

tion for the year of tin concentrate, nickel concentrate, antimony ore, copper ore, manganese ore, asbestos, graphite, talc, and salt.

THE NETHERLANDS

The Netherlands is not in an area of extreme mineral wealth. The Limburg coal deposit in the far south of the country reported a production in December of 24,000 tons per day, which is more than 50 percent of the 1938 average of over 44,000 tons per day. The iron and steel industry was reported to be operating at the end of the year at approximately 60 percent of the 1940 production. The tin- and zinc-smelting industries were relatively inactive during 1945 because of a lack of foreign imports. The diamond-cutting industry showed steady improvement.

NORWAY

The loss of the German market, which consumed over 70 percent of Norwegian mineral exports, considerably depressed the industry in 1945. During the latter half of the year, not 1 ton of iron ore was exported. The Norwegian iron and pyrite ores are complex, and the German metallurgical plants were the only plants equipped to treat these ores. The associated copper and zinc industries are also in a depressed state.

Norway has no domestic bauxite, and the companies controlled by French, English, and Canadian interests did not operate because of the insufficient price differential between alumina and aluminum. The Norsk Aluminium Co. A/S was able to operate most of the year and attained an annual rate of 7,000 tons of its 8,000-ton capacity because this company could treat a year's supply of bauxite which the Nazis left. The Germans made extensive plans to increase the capacity of the Norwegian aluminum industry from a prewar 35,800 tons to 176,000 tons, with the addition of eight plants to the present six. The war ended with little or no construction of the plants begun, and it is questionable whether these plants ever will be completed, with the exception of the alumina plant at Sandesjøen and the aluminum plant at Aardel.

POLAND

Reports indicate that the Polish mineral industry made remarkable progress in returning to normal in 1945. Coal, iron and steel, lead and zinc, petroleum, and salt were all reported approaching prewar levels. It must be pointed out, however, that the boundaries of Poland shifted considerably in 1945 and that any comparison must be placed on that basis.

Coal production had a monthly rate of 3,000,000 tons at the end of 1945. Coke and briquet production also increased during the year. The 1945 output was 21,004,477 tons of coal, 934,365 tons of coke, and 59,599 tons of briquets.

In the last 11 months of 1945 the Polish lead-zinc industry mined 236,857 tons of zinc ore and smelted 36,385 tons of metallic zinc. This compares to a 1940 production of about 120,000 tons of metallic zinc. During the same period in 1945, 6,861 tons of lead and 49 tons of cadmium metal were produced. Production of pig iron in 1945 was 211,278 tons, while the steel ingots output totaled 486,566 tons. Production of iron ore was slow in approaching prewar volume. Polish salt production reached 15,000 tons a month during 1945.

PORTUGAL

Generally increased activity was noted in the Portuguese mineral industry for 1945, with sharp decreases in the production of tin and tungsten ore.[16] Coal production increased to 582,089 tons compared to 553,609 tons in 1944. Anthracite constituted 436,117 tons of the 1945 production. Domestic production was 54.4 percent of the 1945 coal consumption, with imports, chiefly from United Kingdom, totaling 1,070,750 tons. An increase in available shipping space explained an advance in pyrite production in 1945 to 170,967 tons, compared to 131,890 tons in 1944. Metal content of copper produced in 1945 amounted to 219 tons, mainly as cement copper, from the leaching and precipitating operations of the São Domingos mine. Sulfur production from sublimation at the same mine increased to 13,243 tons in 1945 compared to 10,948 tons for 1944.

Tin production was 591 tons, metal content, for 1945 compared to 1772, tons the previous year. Portugal also reported small productions of gold, manganese, chrome ore, lead, tungsten, titanium, and kaolin and increased production of tripoli and cement.

RUMANIA

The petroleum industry of Rumania again resumed an important role in 1945 after the destructive operations directed against it in World War II. Production from the four principal fields was 4,640,000 tons in 1945 compared to a 1939 production of 6,240,000 tons. The Prahova district continued to supply the bulk of the petroleum, with 3,103,000 tons for 1945. The Astra Romana continued to be the major producing company for the year, with an output of 1,572,043 tons. Drilling operations in 1945 were 50 percent of normal. Coal production for the year was estimated at 1,750,000 tons, the Petrosani Co. continuing to be the most important producer. Information on the rest of the Rumanian mineral industry is lacking.

SPAIN

The Spanish mining industry suffered from a power and water shortage in 1945 due to a serious drought during the year.[17] The lead, copper, and sulfur industries were particularly affected. The tungsten, amblygonite, mica, and strontium mines were again inactive.

Coal production was highest on record, with 11,953,755 tons. The Puertollano shale-oil distillation plant continued operation throughout the year. Iron-ore production continued strong owing to heavy British demand. Pyrite production for 1945 was 406,700 tons compared to 512,249 tons for 1944; but copper production decreased to 5,042 tons compared to 10,891 tons of copper content for 1944, and the associated sulfur industry decreased from 29,576 tons in 1944 to 19,300 tons for 1945.

A sharp decline was noted for the lead industry, which produced concentrates with a metal content of 26,175 tons in 1945 compared to 34,776 tons for the previous year. Zinc production was 17,262 tons of metal content, a slight decrease from 1945. Mercury production was 40,089 flasks in 1945, a decrease from the 68,938 flasks produced in 1944. Mercury stocks on hand continued large. The extreme

[16] Information abstracted from reports by Evan Bennett, American minerals attaché, Madrid, Spain.
[17] Bennett, Evan (minerals attaché), Mining Industry, Spain, 1945: State Department Dispatch 444, Madrid, February 1946, 20 pages.

shortage of tin resulted in production of an estimated 600 tons of metal during the year. Tungsten was produced only as a byproduct of the tin mining during the year and amounted to 215 tons.

Potash and phosphate production continued at a normal rate during 1945, with an increased demand for potash toward the close of the year. Potash production was an estimated 115,000 tons of contained potassium salts. Spain also reported a minor production during 1945 of manganese, molybdenum, nickel-chrome ore, antimony, bismuth, gold, fluorspar, graphite, bauxite, mica, magnesite, ferrosilicon, titanium, and ocher.

U. S. S. R.

Accurate information on the status of the U. S. S. R. mineral industry in 1945 was extremely meager. The Russians have released planned production goals for 1950, based on percentage increases over the production or the production goals for 1945 and 1940, but to revert back and assume the 1945 production from these figures results in an extremely problematic sum. The heavy metallurgical industry, sheltered in the Urals, escaped the ravages of the war which the Ukraine suffered and was at peak production during 1945.

The U. S. S. R. is known to have adequate quantities of platinum, phosphate, potash, manganese, chrome, asbestos, iron ore, coal, and pyrite to readily supply its domestic consumption in 1945 and allow an exportable surplus. Nickel production made rapid gains during the war years, and the 1945 production is estimated to approach 15,000 tons of metallic nickel. Production of tin also increased but was far below expectations. Molybdenum production made a slow gain but was far below requirements. Tungsten production was still insignificant. The production of aluminum in 1945 increased less than it did in other aluminum-producing countries for the same year. Magnesium production was insignificant. Copper, lead, and zinc production were not believed to have met expectations in 1945, in the light of the accelerated plans in construction for these nonferrous metals in the 1950 program. The petroleum industry continued at a high rate of development, and enough supplies were obtainable from neighboring countries, particularly Rumania, to supply the demand.

UNITED KINGDOM

The impact of peace after 6 years of war and the transition period to normal vitally affected the mineral industry of the United Kingdom in 1945. The nonferrous metal industry relies mainly on imported ore, and restoration of this trade was not established to any prewar degree during 1945. The lead and zinc industry produced 3,588 long tons of 79.87-percent lead concentrate and 6,360 long tons of 56-percent zinc concentrate in 1945. Tin production in 1945 was 993 long tons, and tungsten production amounted to 71 tons of tungsten metal content in the same year. In the nonmetallics, gypsum, barite, and fluorspar production in 1945 was 1,326,596 long tons, 93,215 long tons, and 43,582 long tons, respectively.

Coal.—The outstanding developments in the British coal-mining industry during 1945 were the further reduction in output, prohibition of practically all exports to conserve available stocks for domestic use, and proposed nationalization of the industry. Strip mining, a war innovation, contributed about 8,000,000 long tons in 1945, about 600,000 long tons less than the 1944 output. Underground mining totaled about 174 million long tons, or about 10 million long tons less than in the previous year. Metallurgical coke production was 13,985 long tons in 1945, and briquet production totaled 922,224 long tons.

Iron and steel.—The iron and steel industry was extremely active during 1945, with a production, slightly under 1944, of 11,808,000 long tons, or 5 percent above the 1935–38 average. Domestic iron-ore production in 1945 was 14,124,347 long tons, averaging 29.03 percent iron. Plans for reequipping, modernizing, and expanding the industry have been formulated by the British Iron and Steel Institute for a 5-year period, which will result in an expected increase in the productive capacity to 18 million long tons annually.

YUGOSLAVIA

At the close of 1945 there was no indication that any real progress had been made toward the general revival of mineral industrial production in Yugoslavia. Metal production was 20 percent, coal production 40 percent, and the production of other minerals 35 percent of the 1939 output. Production statistics were not available for 1945.

OTHER COUNTRIES

Albania.—Information on Albanian mineral production for 1945 is not available at this time.

Bulgaria.—This country was still under an armistice regime, and information on mineral statistics was not procurable.

Czechoslovakia.—Only meager information regarding mineral statistics from 1938 to 1945 has been released. All mines have been nationalized since the end of the war, and during the Nazi protectorate it was believed that statistics were deliberately inaccurate and falsified.

Denmark.—This agrarian country expects to produce 7 million tons of peat in 1945 contrasted to a production of 5,640,000 tons in 1944.

Iceland.—The only mining activity in Iceland in 1945 was the surface digging of peat for domestic consumption.. The Icelandic Government's mineralogist estimated the 1945 production at 11,000 tons compared to 11,973 tons for 1944.

Ireland.—The lack of coal trade with England during the war years resulted in an intensified Irish peat industry, which has a 10-year postwar development program.

Northern Ireland.—The mineral industry of Northern Ireland is insignificant, and there was no change in 1945.

Switzerland.—Insufficient coal continued to be the principal handicap to Swiss economy and industry. The 1945 production was 311,282 tons of coal and 497,429 tons of peat.

THE MIDDLE EAST [18]

By Frank L. Fisher

A revival of interest in the exploitation of Middle East mineral wealth was noted in 1945, with the greatest attention centering on the petroleum resources. The Middle East is primarily an agricultural region experiencing little maladjustment in the economic structure by World War II.

[18] Unless otherwise indicated, statistics for all countries in the Middle East are in metric tons.

IRAN

A production of 107,828 tons of coal (semibituminous) and small amounts of copper, iron ore, antimony, arsenic, sulfur, and nickel ore were reported for the Iranian year March 21, 1944, to March 20, 1945.

IRAQ

Iraq had no significant change in the general economic pattern during 1945. The country's large potential petroleum resources continued to share the spotlight. The Iraqi Government made public its intention of erecting and operating its own refinery at Baiji. Plans were also made in 1945 for two new 16-inch pipe lines. Oil production by Iraqi Petroleum Co. in 1945 was 4,313,400 tons compared to a production of 3,882,600 tons for 1944. Permission was granted the Anglo-Iraqi Co. to prospect for copper during the year. The only mineral reported exploited during the year besides petroleum was coal: a minor quantity was produced.

TURKEY

The Turkish mineral industry was normal during 1945.[19] The production of coal and iron ore increased with coal production totaling 3,716,000 tons (unwashed) compared to 3,560,000 tons (unwashed) for 1944. The iron-ore deposit at Dirvik produced 125,000 tons for the State-owned steel plant at Karabuk. The 1945 chrome production for the year came from the State-owned Guleman mine which produced an estimated 70,000 tons. The private chrome mines were idle during 1945. The 1944 production from all sources was 184,573 tons. Copper production in 1945 was 9,800 tons of blister of which 9,544 tons came from the Ergani mine. Sulfur production remained normal, with an estimated total of 3,000 tons of 65-percent concentrate and 778 tons of refined sulfur. The 1945 production of salt from all sources was 271,496 tons. The meerschaum pits near Eskisehir were reopened during the year. Production of coke and lignite was normal. The emery mines were inactive during the year, as were the antimony mines near Turhal. Production of manganese, mercury, and magnesite was insignificant.

The Turkish Mining and Prospecting Institute was extremely active and examined 1,300 mineral deposits. A hematite deposit was discovered at Sogutlu, near Adapazari, a few miles east of Istanbul, with reserves estimated at several million tons. Bauxite deposits were discovered in the area of Antalya and Iskenderun.

OTHER COUNTRIES

Cyprus.—This island was greatly affected by war conditions, and revival to normal operations was necessarily slow during 1945. Cyprus exported 3,797 tons of asbestos, 1,070 tons of chrome iron ore concentrates averaging 48 percent Cr_2O_3, and 101,676 tons of cupreous iron pyrites averaging 48 percent sulfur and 1 to 2 percent copper in 1945.

Palestine.—A partial exodus of the diamond-cutting industry back to Antwerp was the most significant factor in the Palestine mineral

[19] Lawson, Edward R. (counselor of embassy for economic affairs), Turkey. Annual Economic Review—1945 (Minerals compiled by J. R. Short, Jr.), State Department Dispatch 131, Ankara, Turkey, Mar. 1, 1946, 98 pages.

industry in 1945. Extraction of minerals from the Dead Sea continued at a normal rate, the Government sharing the 5-percent royalty with Trans-Jordan. Production of potash, the major mineral extracted, was 93,625 tons containing 80 percent KCl.

Saudi Arabia.—The Saudi Arabian Mining Syndicate resumed gold operations in March 1945.

Syria.—Mineral production in Syria, including Lebanon, Latskia, and Djebel Druse in 1945, was 190,000 tons of cement, 12,000 tons of salt, 13,000 tons of asphalt, 300 tons of ocher, and small amounts of sulfur, manganese, lignite, and bitumen.

Trans-Jordan.—This agricultural country produced 4,867 tons of raw phosphate in 1945, a slight decrease from the previous year. Trans-Jordan also reported minor production of kaolin, manganese, silica sand, and ocher, which are used in domestic brick and pottery manufacture.

THE FAR EAST AND PACIFIC AREAS

By Nelson Dickerman

Termination of hostilities in 1945 resulted in complete collapse of the temporary but far-flung economic structure set up by the military expansion of Japan. The former peacetime channels of industry and commerce are not yet reestablished.

India, Australia, Ceylon, New Caledonia, and New Zealand face conversion from war to peacetime activities. The Philippines, Netherlands East Indies, Burma, Malaya, Siam, French Indochina, and parts of China must recover from the effects of invasion before an effective and permanent economy can be inaugurated. Mineral resources developed under the domination of Japan will be revised to fit the industrial needs of the individual countries.

Production figures for the year are far from complete, but fragmentary evidence is sufficient to indicate trends and to show the state of an economy almost paralyzed by the effects of the war.

AUSTRALIA

Australia found that the transition to peace was not easy. Many factories had been built to produce the goods formerly imported, but the cancellation of contracts for war minerals also forced curtailment in many mines. Minerals and metals declined from their 1944 production, especially coal, on which the iron and steel industry largely depends. Production was estimated at 1 million long tons less black coal than the 13,721,468 tons in 1944.

Iron and steel.—The Broken Hill Proprietary Co., which owns the large steel works at Newcastle, is developing the Cockatoo Island, Yampi Sound (Western Australia), iron-ore deposits and planning to build four ore vessels of 12,500 tons to bring the ore to Wyalla, Newcastle, and Port Kembla, South Australia. They are also investigating the iron-ore deposits on New Caledonia, estimated to be 30 million tons, which could be blended with the Australian ore. They are also putting in a new 10-inch rod and bar mill at Port Kembla and a new battery of byproduct-coke ovens at the same place. The manufacture of alloy steels will be continued. Zirconium is being substituted for vanadium in many steels.

Petroleum.—The Lithgow Shale Oil Works at Marrangaroo, New South Wales, which was opened 5 years ago as a war measure, has been closed. During the war it produced 2 million gallons of crude from which 1 million gallons of gasoline were refined. Bitumen & Oil Refineries, Ltd., an American-Australian company, is planning oil refineries in New South Wales and Victoria to use crude supplied by the California-Texas Oil Co.

Nonferrous metals.—The large output of copper from the Mount Isa mine in Queensland has been stopped. A new mill to treat 30,000 tons of 4-percent copper ore a month and a copper smelter with a capacity of 1,500 tons of blister copper a month are to be added to the present works. The mine and the old mill have been turned back to treating the lead-zinc ore they were designed for. Magnesium metal is now being produced in quantity by the Broken Hill Pty. Tin production continues at about 2,500 tons a year. Gold production was about the same as in 1944, but plans are being made to open up many mines closed down by the war and lack of labor. In New Guinea the Bulolo Dredging Co. is planning to restart operations. Crews are restoring the dams and dredges. The greatest difficulty is lack of transport and shipping.

Extensive asbestos deposits have been opened up in the Hammersley Range of Western Australia.

BURMA

Political friction has interfered with economic rehabilitation since the Japanese capitulation. It is reported that the Bawdwin lead-zinc-copper-nickel-silver mine will not be back in production for 3 years because of damage to the mine plant, railroad track, and bridges.

The oil fields are being restored but the refineries must be rebuilt completely.

No reports have been received on the tin dredges in the south or the Mawchi tin-tungsten property.

CEYLON

Crystalline graphite, the principal strategic mineral of Ceylon, is produced for export only. Output decreased in 1945. Gem stones were in great demand, and prices were high for stones, including sapphires, alexandrites, cat's eyes, beryls, aquamarines, topaz, tourmalines, spinels, garnets, zircons, and moonstones. Salt production exceeded local demand and was exported.

CHINA

China Proper.—Not many factual data on the mineral output for 1945 are available. The large mines of the Kailan Mining Administration in northern Hopeh Province were producing 11,000 long tons of coal a day in March 1946 as against 9,000 tons in December 1945. The Chunghsing coal mines and Mentoukou anthracite mines in Hopeh were down to 1,700 and 800 long tons daily in early 1946. Production could be stepped up to 6,000 tons a day at each, if new power plants were installed.

All coal mines in other parts of China are producing below prewar figures, causing much interruption to transport, both railroad and steamer. The northern Kwangtung Province coal mines are in bad shape due to war damage and looting. The Fookwok Mining Co. mines are idle, as is the former Kan-ah-tung mine.

Many of the tin, tungsten, antimony, and mercury mines are closed owing to the political instability and to the fluctuations in Chinese currency.

Formosa.—Production activity under the Chinese Government is unknown. Japan had developed the island with many agricultural and industrial plants, leading to surpluses for export of sugar, salt, camphor, coal, copper, gold, and sulfur.

Manchuria.—Production figures for 1945 are lacking. The Russians withdrew occupational forces by April 30, 1946. Removal by the Russians of critical pieces of machinery, power generators, and railroad equipment crippled the mineral industry. Production at the large Fushun coal mine was reduced from 30,000 tons a day to 1,000 tons, all of which was badly needed by the railroads. The steel, chemical, and paper industries are closed.

Years will be required to restore equipment and technical supervision needed to reestablish the industrial position of Manchuria which amounts to more than 70 percent of the entire Chinese production capacity.

FRENCH INDOCHINA

Chinese, British, and French troops occupying the country after the Japanese surrender met native resistance, but comparative peace has been reestablished. The coal washing and loading equipment near Haiphong was badly damaged during the war and will require extensive and time-consuming repair. The four tin mines will require 6 months to a year of repair before production is resumed. The tin smelter at Haiphong is reported to be intact, but only 550 metric tons of tin and 570 tons of 40- to 70-percent concentrate were found after the Japanese evacuation. The mining of apatite rock was reported to have been expanded by the Japanese to a production rate of 150,000 to 200,000 metric tons a year. No report of the zinc mines has been received.

An agreement between the French and the Chinese giving the Chinese shipping rights on the Haiphong-Kunming railroad and duty-free export from Haiphong has been of no help, because much of the roadbed, rails, and bridges was destroyed or removed and replacements have not been made.

INDIA

Conversion from production of war materials to peacetime operation is delayed by political instability.

The coal situation is improved by the importation of more machinery and by raising the working standards of the miners. The iron and steel industry is in much better shape because of expansions and improvements made during the war.

Intensive search was made for strategic minerals during the war, but India is still deficient in oil, copper, lead, zinc, sulfur, and tin. Exportable surpluses of mica, manganese, and chrome will be in demand for other countries. Aluminum and magnesium industries await future development.

War contracts for beryl were terminated on January 1, 1946, and shipments of thorium sands to the United States were discontinued by the Dewan of Travancore in April 1946.

A strong movement has been started in India to require that raw minerals, including monazite and other sands, shall be processed at home before being shipped abroad.

JAPAN

Japan was reduced essentially to the four home islands. Not only the territorial gains of the war, but also Formosa, the Ryukyu Islands, Korea, Manchuria, the Kurile Islands, the southern half of Sakhalin Island, and the Marshall, Caroline, and Marianas Island groups are lost to Japan. Consequently, Japanese industry must be curtailed as well as modified to meet drastically reduced raw material supplies and to reduce war-making potentialities.

Coal.—Monthly production of coal mines in the Japanese home islands, which averaged 5,500,000 metric tons in 1942, dropped to 600,000 tons in October 1945 but was back to 1,400,000 tons in March 1946.

Iron and steel.—Capacities and incomplete production figures for iron and steel are given:

	1944 annual capacity (metric tons)	*December 1945 production (metric tons)*
Pig iron	6, 588, 000	9, 036
Electric furnace steel	3, 335, 000	(1)
Open-hearth steel	10, 633, 000	8, 770
Rolled steel	8, 702, 000	(1)

1 Data not available.

Petroleum.—Petroleum production was not affected seriously by the war. About 3,700 barrels of oil were produced from 4,526 wells in October 1945, which amounts to approximately 15 percent of requirements. A survey is in progress to determine possible increases.

Nonferrous metals.—Refined-copper production was over 120,000 metric tons for 1943, but only an estimated 400 metric tons were produced in January 1946. Lead mine production was 22,706 metric tons in 1943, and the forecast for 1946 was 8,680 tons. Zinc mine production was 93,307 metric tons in 1943 and 32,770 tons forecast for 1946. Aluminum production amounted to only 59 tons in December 1945 compared with 109,525 tons produced in 1944. Cement production dropped from the 4,250,000 metric tons per annum rate of 1940 to less than a million tons in 1945. Antimony refined in January 1946 was 13 metric tons and nickel refined 36 metric tons. A manganese production of 400,000 metric tons in 1944 averaged only 31 percent in grade.

KOREA (CHOSEN)

The political future of Korea has not been established in terms of economic unity. Occupational division, with the Russians north of the 38° parallel and Americans to the south, has divided the area and interfered with the possible development of self-sufficiency.

The north is predominantly industrial, with most of the developed hydroelectric power, coal, and gold mines. The south, predominantly agricultural, has deposits of asbestos, molybdenum, graphite, nickel, lead, and zinc. Coal is relatively inaccessible, and since none is coming from the Russian mines in the north it is being supplied by an allotment of 70,000 tons a month from Japan.

The railroads need rolling stock and repairs, which will come largely from Japan.

MALAYA

The condition of the tin dredges and hydraulic and washing plants in Malaya was much better than had been expected. Machinery on tin dredges was much run down, due to improper lubrication and lack of replacement of parts. Some of the motors, tools, and supplies had been taken away and will have to be replaced. Repair shops, tin cleaning plants, offices, and houses had not been maintained. Older dredges had been damaged by neglect. The loss of power plants in some cases was serious. However, operation was partly resumed, and engineers have placed orders for machinery and supplies. The Chinese dulong washers and pit mines were put in operation and for the first quarter of 1946 produced 802 long tons of tin-metal content, about equally divided between the two methods. By March 1, 1946, 91 mines, including 4 dredges, were operating.

The return to normal production will be hindered by the long time required for delivery of needed machinery, supplies, and spare parts. The scarcity of coal, petroleum and its products, food, and clothing is slowing many operations; but every month probably will see increased output of tin, and by the beginning of 1947 stocks of tin should be much larger.

Luckily, the large public power plants were not damaged. The output of coal will have to be stepped up to supply the railroads. The iron and bauxite mines worked by the Japanese will not be opened immediately.

NETHERLANDS EAST INDIES

Like Malaya, the tin mines in Bangka, Billiton, and Singkep Islands were found in early 1946 in much better condition than had been expected. The dredges were much the worse for wear and neglect, but some were soon back in operation. One underground mine at Bangka was badly damaged and may never be reopened. Some 5,000 tons of tin metal and some concentrates were found at Bangka, which the Japanese could not remove. The smelters can be put in operation without undue delay. The Billiton Co. announced on June 28, 1946, from The Hague that 6 large bucket dredges, 2 large suction dredges, and 11 small suction dredges were operating at Billiton. At Bangka 9 tin mines are operating, but no large dredges. Two large dredges are expected to start up there in August 1946.

No report on the nickel mines on Celebes has been received or on the condition of the bauxite mines on Bintan and Kojan Islands near Singapore. These are the best bauxite deposits so far known in the Far East. The petroleum fields in Borneo are being restored and by early 1946 were shipping oil abroad. The condition of the oil fields and refineries on Sumatra is not known here, but as soon as political conditions permit they will be rapidly restored to production. The same is true of the coal mines on Sumatra.

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NEW CALEDONIA

Exports of nickel matte to the United States terminated on June 30, 1945, when the contract expired, and the matte now is being shipped to France; 5,098 metric tons of 76- to 79-percent nickel matte were shipped in 1945. Chrome ore amounting to 50,952 metric tons was shipped to the United States and to France in 1945.

NEW ZEALAND

Coal production increased to an estimated 2,825,000 long tons from 2,805,970 long tons in 1944 but was still short of demand. Gold production in 1945 is estimated at 125,000 fine ounces compared with 142,287 fine ounces in 1944. The drop is due to lack of labor and essential supplies. Manganese and mercury production was discontinued after the termination of hostilities, but some scheelite was still being mined by private operators.

PHILIPPINE ISLANDS

The Philippine Islands attained independence on July 4, 1946. The new government is faced with the enormous task of restoring commercial and industrial activity. Most of the mines and factories were badly damaged or looted, and both machinery and supplies must be imported.

The American Government has furnished large quantities of former military construction and transportation equipment and will assist financially in the restoration and rehabilitation program. Free trade with the United States for 8 years will be a helpful factor.

Many of the large mining and industrial companies in which Americans were interested have retained engineers to advise on reconstruction, and new companies are being organized for development purposes.

SIAM

Tin dredges and mines in Siam suffered no war damage but are badly run down through lack of maintenance and repair. No reports of resumed operations have been received.

U. S. S. R.—SIBERIA

Information is meager on resource developments of the Provinces bordering on the Sea of Okhotsk and the Sea of Japan. The Russians have built steel and manufacturing plants at Komsomolsky and Kharbarovsk, as well as oil refineries to handle crude oil from Sakhalin Island. The Soviet press has reported that oil production in the northern part of Sakhalin Island is being expanded, and total production is expected to be at the rate of 4 to 5 million barrels a year. Coal production on the island and in the Maritime Provinces is greater than before the war, and further expansion is planned. New mineral deposits are reported, but data on quality and reserves are lacking.

INDEX

By Mabel E. Winslow

C

D

Q

R

W